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# Synopsis of aroids (Alismatales, Araceae) from Cerro Pirre (Darién Province, Panama)

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**Abstract**
Ninety-four species belonging to 12 genera of Araceae are recorded on Cerro Pirre (Darién Province): *Adelonema* Schott (two); *Anthurium* Schott (39), *Chlorospatha* Engl. (2), *Dieffenbachia* Schott (3); *Heteropsis* Kunth (1); *Monstera* Adans. (6); *Philodendron* Schott (28), *Rhodospatha* Poepp. (2); *Spathiphyllum* Schott (2); *Stenospermation* Schott (3); *Syngonium* Schott (4) and *Xanthosoma* Schott (2). Taxonomic notes, identification key and comments on habitat and ecology of the species are presented.

**Keywords**
Biodiversity, Central America, endemic species, taxonomy, World Heritage Site.

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## Introduction

Araceae is the most species-rich family within the order Alismatales (Stevens 2001 onwards; Chase 2004). The family comprises about 3645 described species in 144 genera and is distributed worldwide, in habitats ranging from open freshwater to deserts, occurring on all continents except Antarctica (Mayo et al. 1997; Boyce and Croat 2018). In the Neotropical region there are about 2113 species, distributed in 41 genera (Boyce and Croat 2018). Species diversity generally increases in Central America as one approaches South America, but the richest areas of diversity are in the Andes (Croat 1986a, 1992, 1994). In Central America, it has about 778 species in 23 native genera and the diversity of species is mainly concentrated in Costa Rica and Panama. Actually, Panama has 436 described species in 26 genera (but it is estimated that there are more than 600 species) and contains 12% of the described species of Araceae in the world (Ortiz et al. 2018). Although it seems that the Panamanian aroid flora is reasonably well known, the knowledge of this group of plants is still poor in several parts of the country, mainly in the Caribbean slope and in the isolated mountains of the Darién Province (Croat 1986b; Ortiz et al. 2018, 2019).

The Darién Province represents one of the most important and most biodiverse natural sites in Panama, since it contains a great richness of species and a high degree of endemism (Dinerstein et al. 1995). Correa et al. (2004) listed a total of 2638 species of vascular plants for Darién, including 121 species of Araceae. According to Polanco (2000), the Araceae family represents the group of vascular plants with the highest endemism in Darién. Despite the great biological importance of the Darién,

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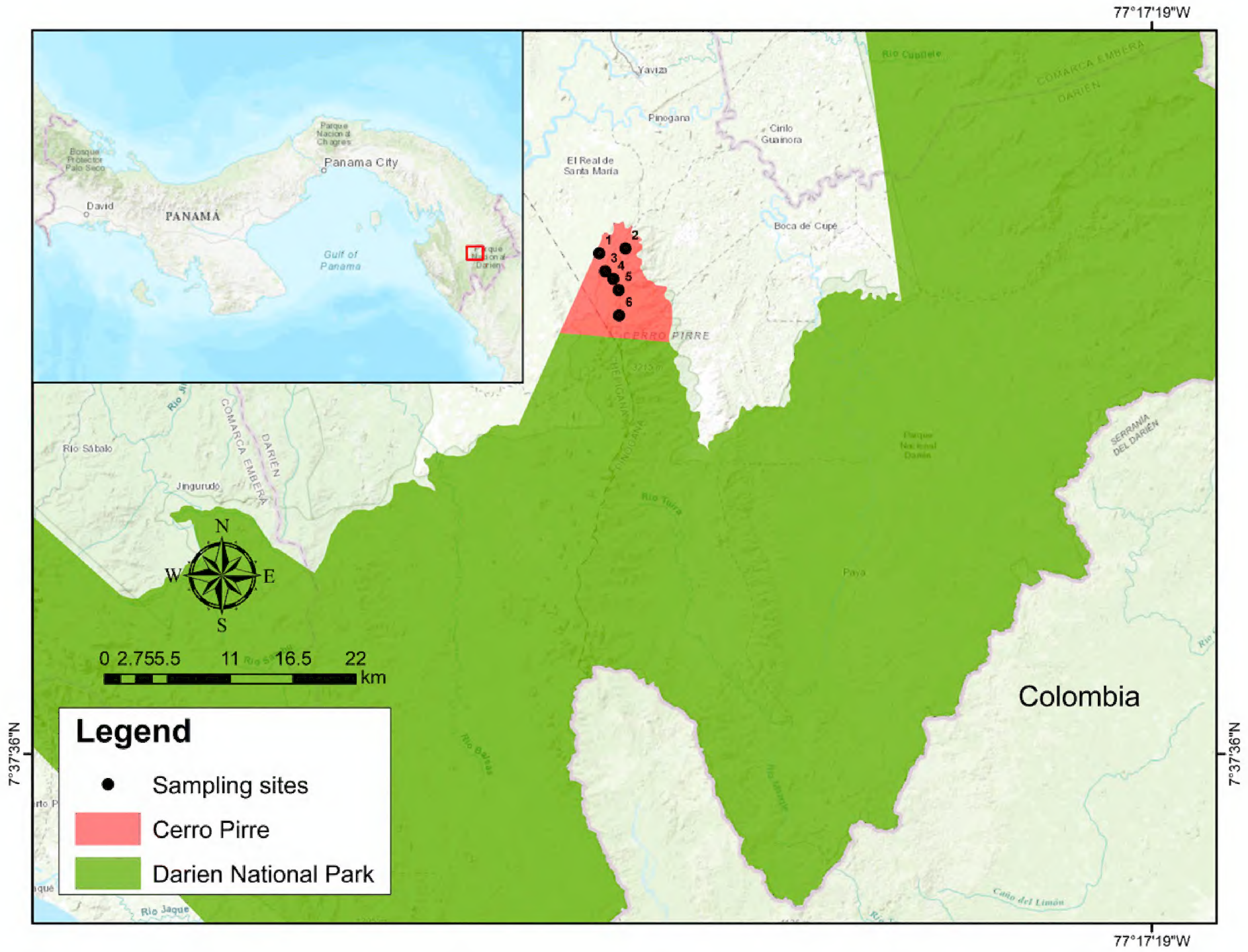


**Figure 1.** Location map of Cerro Pirre area in Darién National Park, with the sampling sites: Site 1 (Cascada-Station trail), Site 2 (Antena trail), Site 3 (Mirador 1), Site 4 (Mirador 2), Site 5 (Rancho Plástico), and Site 6 (Rancho Carajo).

this mega-diverse site faces many threats in terms of its conservation. ANCON (2010), mentioned that among the great threats that are currently affecting the Darién National Park, are agricultural activities, extensive livestock grazing, illegal extraction of wood, and some forest practices incompatible with sustainable development.

The Darién National Park protects an area of 579,000 ha located in the Darien Province (Figure 1). It represents the largest natural reserve in the country and is currently considered a Biosphere Reserve and a World Heritage Site as established by UNESCO (Gradstein and Salazar 1992). Within the limits of the Park there are several isolated mountain ranges that comprise large areas of cloud forests, important for their biological singularity and for their high degree of endemism (Bermúdez et al. 2000). Among them are the San Blas (Guna Yala), Darién, Sapo, Majé, and Pirre mountain ranges (ANAM 2010).

As there is no detailed study on Araceae in the Darién National Park (including Cerro Pirre), this work is intended to contribute to our knowledge of this botanically important area's rich biodiversity.

## Methods

The study was carried out on Cerro Pirre, a mountain located within the Darién National Park (Fig. 1), within the geographic coordinates of 08°01′8″N, 077°44′05″W. Cerro Pirre has an elevation gradient that extends from 90–1550 m (Robbins et al. 1985). The climate of the area is humid tropical, the average annual temperature is 20–25 °C and the average annual rainfall is 3000–3500 mm, with a pronounced dry season during January to April (Gradstein and Salazar 1992). The study site is located within the Eastern Panamanian montane forests ecoregion (Powel et al. 2018). It has four types of vegetation: semideciduous lowland forests, evergreen lowland forests, evergreen submontane forests, and evergreen montane forests (ANAM 2010). According to the Holdridge et al. (1971) system, Cerro Pirre has four life zones: Premontane wet forest, Tropical wet forest, Premontane rain forest, and Lower montane rainforest life zones.

To collect material and study the species in the field, three field trips of 8–12 days were carried out during April, July–August, and December of 2016. Sampling was conducted at six sites along the elevation gradient of the Cerro Pirre area (Figure 1): Site 1 (Cascada-Station trail) 08°01′01″N, 077°43′22″W, 186 m; Site 2 (Antena trail) 08°01′14″N, 077°42′08″W, 555 m; Site 3 (Mirador 1) 08°00′10″N, 077°43′05″W, 522 m; Site 4 (Mirador 2) 07°59′49″N, 077°42′42″W, 610 m; Site 5 (Rancho Plástico) 07°59′18″N, 077°42′27″W, 1109 m;

Site 6 (Rancho Carajo) 07°58′06″N, 077°42′26″W, 1188 m. Photographs of the species were taken and the collections were preserved in 70% alcohol. All specimens collected were deposited at the University of Panama Herbarium (PMA) and the duplicates were deposited in the Missouri Botanical Garden Herbarium (MO). The collections were made taking into account the methodology proposed by Croat (1985).

In order to complement the species list, databases and collections deposited in PMA, MO, and Smithsonian Tropical Research Institute (SCZ) herbaria were consulted. The geographical distribution of the species was obtained from Central American floras (Croat and Stiebel 2001; Grayum 2003), checklists and catalogues (Brako and Zarucchi 1993; Balick et al. 2000; Correa et al. 2004; Funk et al. 2007; Nelson 2008; Idárraga-Piedrahita et al. 2011; Croat and Acebey 2014; Dorr and Stergios 2014), and online resources and databases (Coelho et al. 2015; TROPICOS 2018; WCSP 2018) The acronyms of all herbaria mentioned are according to Thiers (2018).

For identifications, the following taxonomic treatments were consulted: Bogner and Nicolson (1991), Cardona (2004), Castaño-Rubiano (2011), Carlsen and Croat (2007), Croat (1981, 1983, 1986b, 1991, 1997, 1999, 2004), Croat and Carlsen (2013), Croat and Hannon (2015), Croat and Ortiz (2016), Grayum (1996, 2003), Madison (1977), Mayo (1991), Soares et al. (2013), Wong et al. (2016), Zhu and Croat (2004). All identified taxa were compared with the types present in PMA and MO. In the case that some type was absent in the mentioned herbaria, the database of digitized plants JSTOR Global Plants was consulted (Gallagher 2010). The descriptive terminology follows Croat and Bunting (1979). The determination of terrestrial, epiphytic and nomadic vine life forms was made using the classifications proposed by Croat (1988), Schimper (1903) and Zotz (2013), respectively.

## Results

The Araceae on Cerro Pirre consists of 94 species (including 11 morphospecies) were recorded in 12 genera: *Adelonema* Schott (2), *Anthurium* Schott (39), *Chlorospatha* Engl. (2), *Dieffenbachia* Schott (3), *Heteropsis* Kunth (1), *Monstera* Adans. (6), *Philodendron* Schott (28), *Rhodospatha* Poepp. (2), *Spathiphyllum* Schott (2), *Stenospermation* Schott (3), *Syngonium* Schott (4), and *Xanthosoma* Schott (2) (Figs 2–8). Currently, the morphospecies identified are under additional taxonomic studies and have been classified into the following genera: *Anthurium* Schott (7), *Chlorospatha* Engl. (1), *Philodendron* Schott (1), *Stenospermation* Schott (1), and *Syngonium* Schott (1). The family is highly abundant and diverse in the study area, it is distributed in virtually all habitats along the elevation gradient, but the richness is accentuated in the mid-elevation sites (500–900 m) and the endemism excels mainly in the cloud forests that are above 1000 m.

The identification key includes the genus *Dracontium*, since *D. grayumianum* G.H. Zhu & Croat occurs in the surrounding areas near the outer limits of Pirre and it is very possible that it is found on Cerro Pirre. Additionally, we provide in alphabetical order, habitat, ecological, and identification notes for all described species (excluding morphospecies) found on Cerro Pirre.

### Key to the Araceae of Cerro Pirre

1. Spadix uniform (sometimes with sterile flowers at the spadix base); flowers bisexual, perigoniate or naked ..... 2
1′. Spadix segmented, clearly divided into basal female zone and apical or intermediate male zone; flowers unisexual, always naked ..... 58

2. Stem cormose; leaf solitary or absent, petioles colored with reptilian patterns, blade divided into three sections (dracontioid leaves) ..... ..... *Dracontium grayumianum*
2′. Stems never cormose; leaves usually >1, blade simple, lobed, pedati-compound, or palmately compound ..... 3

3. Spathe usually persistent after flowering; flowers perigoniate ..... 4
3′. Spathe usually deciduous after flowering; flowers naked ..... 47

4. Plants generally terrestrial; stem almost obsolete; leaves distichous, collective veins absent; tepals 4–6, free or fused; plants usually associated with streams or sites with flooded soils ..... 5
4′. Epiphytes, nomadic vines or terrestrial plants (sometimes epilithic); stem evident; leaves arranged in spiral, collective vein usually present, tepals generally 4, free; habitats diverse ..... 6

5. Blades usually with denticulate margins (when fresh); spathe markedly decurrent into peduncle, tepals free, style tapered and exserted ..... ..... *Spathiphyllum phryniifolium*
5′. Blades generally with entire margins; spathe not decurrent in the peduncle, tepals fused, style obsolete ..... *Spathiphyllum laeve*

6. Blades divided (pedati-compound or palmately compound) ..... 7
6′. Blades entire (simple or lobed) ..... 9

7. Plants robust with stems ≥3.0 cm wide; leaflets with margins markedly sinuate to pinnatifid; spadix red-purple ..... *Anthurium clavigerum*
7′. Plants of medium size with stems up to 2.5 cm wide; leaflets with entire margins (sometimes the lateral leaflets can be subauriculate at the base); spadix white-gray or lilac ..... 8

8. Side leaflets usually subauriculate at the base; peduncle less than half the petiole length (usually

≤6.0 cm long); spadix green or white grayish ..... .....*Anthurium pentaphyllum* var. *bombacifolium*

8′. Leaflets slightly unequal, but never subauriculate; peduncle more than petiole length (usually ≥20 cm long); spadix lilac.....*Anthurium kunthii*

9. Leaf blades markedly trilobed.....10
9′. Leaf blades entire, never lobed..... 12

10. Cataphylls intact on the upper nodes; spadix pale pink .....*Anthurium rubrifructum*
10′. Cataphylls fibrous on the upper nodes; spadix yellow.....11

11. Blades with posterior lobes narrowly rounded or falcate, both extending laterally at an angle of 50–60° *Anthurium trilobum*
11′. Blades with posterior lobes broadly rounded at the apex, both extending laterally at an angle ≥90° ..... *Anthurium panduriforme*

12. Blades dark glandular-punctate on at least one surface..... 13
12′. Blades typically eglandular, lacking dark glandular punctations on either surface..... 25

13. Climbing epiphytes with slender and elongated stems (erect to scandent); internodes long (usually ≥3 times longer than wide); leaves arranged along the stem .....14
13′. Terrestrial plants or non-climbing epiphytes with short stems and compressed internodes (frequently less than 2 times longer than wide); leaves congested at apex of the stem .....16

14. Cataphylls intact and deciduous; spadix reddish ..... .....*Anthurium tonduzii*
14′. Cataphylls fibrous and persistent; spadix green, white or lilac .....15

15. Spathe erect at anthesis, spadix large (usually >2.0 cm long) with 4 or 5 flowers in the alternate spiral; berries acute at the apex; lowland to mid-elevation forests (<700 m) .....*Anthurium obtusum*
15′. Spathe reflexed at anthesis, spadix small (usually up to 1.5 cm long) with <4 flowers in the alternate spiral; berries rounded at apex; cloud forests (>1000 m)..... .....*Anthurium scandens* subsp. *pusillum*

16. Blades dark glandular-punctate on both surfaces .... .....17
16′. Blades dark glandular-punctate only on lower surface..... 22

17. Plants with pendent leaves, blades linear-oblanceolate, berries orange ..... *Anthurium pendens*
17′. Plants with erect leaves, blades never linear, berries white or purple (unknown in *Anthurium* sp. 7).....18

18. Primary lateral veins emerging from the midrib at an angle of ≤35°; spadix purple, brown or white...19
18′. Primary lateral veins emerging from the midrib at an angle ≥50°; spadix green ..... 20

19. Primary lateral veins up to 5 per side; spadix brown or purple..... *Anthurium* sp. 7
19′. Primary lateral veins usually ≥15 side; spadix white-creamy to grayish..... *Anthurium lancifolium*

20. Primary lateral veins usually >15 per side; spadix with 2 or 3 flowers in the alternate spiral, lateral tepals broad (4.2 mm wide)..... *Anthurium* sp. 6
20′. Primary lateral veins usually <15 per side; spadix usually with 4 or more flowers in the alternate spiral, lateral tepals narrow (≤1.5 cm wide) .....21

21. Spadix with 4–5 flowers in the alternate spiral, tepals thickened and raised in the outer margin..... .....*Anthurium crassitepalum*
21′. Spadix with 8–9 flowers in the alternate spiral, tepals never thickened and raised in the outer margin .....*Anthurium terryae*

22. Length of the petioles generally more than the length of the leaf blade..... *Anthurium* sp. 5
22′. Length of the petioles generally less than the length of the leaf blade..... 23

23. Plants with pendant leaves; blades narrowly linear to lanceolate (usually ≤4.0 cm wide); berries yellow or orange..... *Anthurium friedrichsthalii*
23′. Plants with erect leaves; blades oblong, elliptical, obovate or oblanceolate (generally >3.0 cm wide); berries red or purple..... 24

24. Roots densely clustered; spathe green with purple spots, spadix thick (11.05 cm diam. at base), green turning red-violet; low or mid-elevation forests (<1000 m..... *Anthurium ramonense*
24′. Roots lax; spathe usually green, spadix slender (≤5 mm diam. at the base), green; cloud forests (>1100 m)..... *Anthurium pirrense*

25. Blades attenuated to cuneate, rounded, truncate or sub-cordate at base, sinus <2 cm deep ..... 26
25′. Blades cordate, sagittate or hastate at the base, sinus >2 cm deep..... 32

26. Climbing epiphytes with slender and elongated stems (internodes usually ≥3 times longer than wide)..... 27
26′. Terrestrial, epilithic or non-climbing epiphytes with short stems and compressed internodes (usually <2 times longer than wide)..... 28

27. Internodes usually ≥8 cm long; blades drying dark-brown, subcoriaceous to coriaceous.....*Anthurium interruptum*
27′. Internodes usually ≤6 cm long; blades drying yellowish, chartaceous..... *Anthurium* sp. 1

28. Terrestrial, epiphytes or epilithic; cataphylls intact and cucullate .....*Anthurium salvinii*
28′. Plants usually epiphytes; cataphylls lanceolate, semi-intact (fibrous in the basal part) or completely fibrous..... 29

29. Roots densely clustered; spadix light green, mark-

edly stipitate (stipe 1–3.5 cm long) ..... *Anthurium michelii*

29′. Roots lax, spadix purple to red, sessile or short stipitate (stipe usually ≤7 mm long) ..... 30

30. Blades rounded, acute or attenuated at base, basal veins absent; spadix with ≥7 flowers in the alternate spiral..... *Anthurium cerropirrense*

30′. Blades broadly rounded to subcordate at base with 2–4 pairs of basal veins; spadix usually with 4–6 flowers in the alternate spiral.....31

31. Blades with 2–4 pairs of basal veins, usually free; spadix reddish ..... *Anthurium* sp. 3

31′. Blades with 3–5 pairs of basal veins, fused between the first or second pair; spadix violet to purple ..... *Anthurium talamancae*

32. Nomadic vines with slender and elongated stems (internodes usually ≥3 times longer than wide) ..... 33

32′. Terrestrial, epilithic or epiphytes with short stems and compressed internodes (usually <2 times longer than wide).....35

33. Blades >2 times longer than wide, markedly bullate; spadix green to green-whitish ..... *Anthurium niqueanum*

33′. Blades <2 times longer than wide, never bullate; spadix pale pink to fuchsia ..... 34

34. Cataphylls thick, coriaceous and persistent; spathe white or green-whitish, erect to semi-erect and oblong-lanceolate (0.8–2 cm wide) ..... *Anthurium hartmanii*

34′. Cataphylls thin, brittle and deciduous; spathe green, reflexed and narrowly lanceolate (up to 1.0 cm wide) ..... *Anthurium rubrifructum*

35. Spadix of brown, red, violet, lilac, or purple..... 36

35′. Spadix green, white, or yellow .....41

36. Blades with primary lateral veins ≥10 per side .... 37

36′. Blades with primary lateral veins up to 8 per side... 39

37. Blades cordate or subcordate at base, drying brown or reddish-brown; basal veins up to 5 pairs..... *Anthurium talamancae*

37′. Blades markedly cordate at the base, drying yellowish-yellow to pale-yellowish brown; basal veins ≥6 pairs..... 38

38. Plants usually epiphytic; blades >2 times longer than wide, sinus generally hipocrepiform; berries red..... *Anthurium dukei*

38′. Plants usually terrestrial, leaf blades <2 times longer than wide, sinus usually closed or V-shaped; berries lilac or violet-purple..... *Anthurium cuspidatum*

39. Blades drying usually dark brown to reddish brown; mature inflorescences long-pedunculate (peduncle usually >25 cm long)..... *Anthurium brownii*

39′. Blades drying green to yellowish-green; mature inflorescences short-pedunculate (peduncle up to 15 cm long) ..... 40

40. Blades with posterior ribs up to 1.9 cm long or absent; spathe erect, green to creamy-white..... *Anthurium* sp. 4

40′. Blades with posterior ribs 2.5–3.0 cm long; spathe reflexed, green-purple..... *Anthurium rotundistigmatum*

41. Plants generally terrestrial ..... 42

41′. Plants usually epiphytes..... 43

42. Blades velvety-green on upper surface, with major veins discolor (when fresh); primary lateral veins up to 3 pairs..... *Anthurium crystallinum*

42′. Blades light green on the upper surface, with major veins concolor (when fresh); primary lateral veins >4 pairs ..... *Anthurium ochranthum*

43. Adult plants with massive blades (87.0–104.0 × 61.0–75.0 cm); basal veins 9–11 pairs ..... *Anthurium* sp. 2

43′. Adult plants with moderate blades (11.0–75.0 × 5.0–43.0 cm); basal veins up to 9 pairs..... 44

44. Cataphylls thick, coriaceous, intact and persistent on the upper nodes ..... 45

44′. Cataphylls thin, chartaceous, intact or fibrous and deciduous on the upper nodes..... 46

45. Cataphylls 11–18 cm long; blades usually ≥1.7 times longer than wide; spathe erect and cucullate..... *Anthurium cucullispathum*

45′. Cataphylls 8–12.5 cm long; blades usually ≤ 1.5 times longer than wide; spathe reflexed, not cucullate..... *Anthurium curvispadix*

46. Blades panduriform, drying yellow; primary lateral veins numerous (≥15 per side) ..... *Anthurium panduriforme*

46′. Blades not panduriform, drying brown to reddish-brown; lateral primary veins up to 11 per side..... *Anthurium ravenii*

47. Petiole short (<1.5 cm long) without geniculum; blades with inframarginal collective veins near margins..... *Heteropsis oblongifolia*

47′. Petiole prominent (>1.5 cm long) and geniculate; blades usually without inframarginal collective veins ..... 48

48. Epiphytic plants with spirally arranged leaves; blades usually with inconspicuous primary lateral veins .. 49

48′. Nomadic vines or terrestrial plants with distichous leaves; blades with prominent lateral primary veins (except in *Monstera pittieri*) .....51

49. Plants robust with short and thick internodes (0.5–1.5 × 1.5–3 cm); petioles usually more than 15 cm long..... *Stenospermation ellipticum*

49′. Plants small or medium size with slender and elongated internodes (1.0–5.0 × 0.4–0.8 cm); petioles up

to 15 cm long..... 50

50. Internodes drying grayish-brown; spadix creamy-white, sessile or shortly stipitate (stipe up to 0.2 cm long) ..... .*Stenospermation angustifolium*

50′. Internodes drying dark-brown to reddish; spadix yellow, markedly stipitate (stipe 0.5–1.0 cm long) ... ..... *Stenospermation* sp. 1

51. Terrestrial plants, frequently associated with streams or rivers; blades with red dots on the lower surface. ..... *Rhodospatha moritziana*

51′. Nomadic vines with habitats various; blades without red spots on the lower surface ..... 52

52. Blades drying reddish-brown, entire, never perforated; primary lateral veins >25 per side; spadix pink to red-purple ..... *Rhodospatha wendlandii*

52′. Blades drying yellowish-green, yellowish, dark-brown or blackened; entire, pinnatilobed or pinnatifid, sometimes perforated; primary lateral veins frequently <25 per side (in *Monstera oreophila* up to 40 per side); spadix green, yellowish-green, grayish-green, creamy-white, or dark-brown ..... 53

53. Blades of adult plants with secondary venation completely reticulated..... *Monstera dubia*

53′. Blades of adult plants with secondary venation parallel..... 54

54. Blades of adult plants pinnatilobed or pinnatifid (rarely on one side only), never perforated .....55

54′. Blades of adult plants with entire margins, sometimes with perforations ..... 56

55. Juvenile plants with exserted leaves (never appresed to the substrate); petiole sheaths deciduous; blade lobes narrow (1–3 cm wide)..... ..... *Monstera pinnatipartita*

55′. Juvenile plants with leaves tightly appressed to the substrate; petiole sheaths persistent; blade lobes broad (5–14 cm wide)..... *Monstera spruceana*

56. Blades small (10.0–26.0 × 4.0–9.0 cm), perforated or not perforated; primary lateral veins obscure; peduncle up to 4 cm long..... *Monstera pittieri*

56′. Blades large (35.0–65.0 × 15.0–30.0 cm), usually perforated; primary lateral veins prominent; peduncle >5.0 cm long ..... .57

57. Unsheathed portion of the petiole D-shaped in cross section; primary lateral veins 10–20 per side..... ..... *Monstera adansonii* subsp. *laniata*

57′. Unsheathed portion of the petiole U-shaped in cross section; primary lateral veins >25 per side..... ..... *Monstera oreophila*

58. Adult plants with deeply divided blades (trifoliolate or pedati-compound) or markedly trilobed (lobes arranged forward, longer than wide) ..... .59

58′. Adult plants with generally simple, entire, cordate, sagittate or hastate blades (lobes directed backwards, ± as long as wide)..... 64

59. Plants always terrestrial; semi-subterranean stems; leaves up to 1–4 per plant; female portion of the spadix fused to the spathe ..... 60

59′. Nomadic vines; stems aerial; leaves numerous; female portion of the spadix free to the spathe .....61

60. Blades trilobed or rarely trisect (lacking auricles), usually with irregular pale maculations; blades lobes with entire margins.....*Chlorospatha mirabilis*

60′. Blades 5-lobed, usually prominently auriculate, lacking maculations; blades lobes with denticulate margins (when fresh) .....*Chlorospatha* sp. 1

61. Plants with colorless or reddish sap; blades trilobed or trisect; tertiary veins parallel; stamens and berries free ..... *Philodendron tripartitum*

61′. Plants with copious milky sap; blades trisect or pedati-compound; tertiary veins reticulate; stamens fused as synandria; berries fused (syncarp)..... 62

62. Primary lateral veins of the medial segment emerging from the midrib at an angle of ≥35°; spathe tube reddish internally .....*Syngonium hoffmannii*

62′. Primary lateral veins of the medial segment emerging from the midrib at an angle of ≤30°, spathe tube greenish internally (unknown in *Syngonium* sp. 1).. ..... 63

63. Plants frequently of forest edges; petiole sheaths longer than the unsheathed portion of the petiole; auricles of the blade truncate to sagittate or hastate lobed ..... *Syngonium podophyllum*

63′. Understory plants; petiole sheaths shorter than the unsheathed portion of the petiole; auricles of the blade obovate, oblong to elliptically lobed..... ..... *Syngonium* sp. 1

64. Petioles armed with small spines (mainly at base) and/or puberulent to pubescent or densely covered with fleshy scales ..... .65

64′. Petioles unarmed, completely glabrous and lacking fleshy scales..... 68

65. Nomadic vines; stem, peduncles and the outer surface of the spathe densely covered with fleshy scales .....*Philodendron verrucosum*

65′. Plants always terrestrial; stem, peduncles and the outer surface of the spathe without fleshy scales.. 66

66. Plants with abundant milky sap; petioles unarmed, densely pubescent; stamens connate as synandria... ..... *Xanthosoma mexicanum*

66′. Plants with colorless to reddish sap (sometimes absent); petioles armed with small spines (mainly at the base) and/or puberulent; stamens separated... 67

67. Blades markedly peltate and prominently glossy above; midrib whitish on the upper surface (when fresh) ..... . *Adelonema panamense*

67′. Blades basifixed and more or less matte above; midrib concolor on the upper surface (when fresh)..... ..... *Adelonema wendlandii*

68. Blades acute, obtuse, rounded or truncate at base, sometimes slightly cordulate or subcordate, but with posterior lobes ≤¼ of the length of the anterior lobe ..... 69
68′. Blades cordate, sagittate or hastate at base, with posterior lobes prominent, generally >¼ than the anterior lobe ..... 83

69. Plants generally terrestrial, usually with milky sap; female portion of the spadix fused to the basal part of the spathe; stamens fused as synandria; pistillate flowers with free staminodes ..... 70
69′. Nomadic vines without milky sap; female portion of the spadix free to the basal part of the spathe; stamens free; pistillate flowers without staminodes . 72

70. Plants robust, usually with stems >1.0 m tall and internodes >3.0 cm diam.; blades cuneate to rounded or truncated at base; petiole sheaths decurrent at the apex ..... *Dieffenbachia longispatha*
70′. Plants of small or medium size, usually with stems <1.0 m tall and internodes up to 3.0 cm diam.; blades acute, rounded, subcordate or cordate at base; petiole sheaths rounded to auriculate at apex ..... 71

71. Blades drying greenish to grayish-green, frequently with pale-maculations; spadix lacking sterile medial region (male and female regions contiguous) ..... *Dieffenbachia killipii*
71′. Blades drying dark greenish-gray or blackish, usually lacking maculations; spadix with sterile medial region, with male and female portions separated by a distinct naked spadix axis .. *Dieffenbachia isthmia*

72. Adult plants generally with cataphylls (sometimes deciduous); petiole sheaths non-amplexicaule, sheathed for less than half their length ..... 73
72′. Adult plants usually lacking cataphylls; petiole sheaths completely amplexicaule, sheathed for more than half their length ..... 76

73. Petioles lacking a lilac to dark-purple ring at apex; blades usually ≥25 cm wide, 1.7–2 times longer than wide ..... *Philodendron niqueanum*
73′. Petioles with a lilac to dark-purple ring at apex; blades usually ≤25 cm wide, 1.9–6 times longer than wide ..... 74

74. Scandent climbing plants with long and slender internodes (10.0–15.0 × 1.0–1.5 cm), generally >3 times longer than wide ..... *Philodendron immixtum*
74′. Appressed-climbing plants with short and relatively thick internodes (1.0–4.0 × 1.0–4.0 cm), usually <2 times longer than wide ..... 75

75. Petioles D-shaped in cross section with winged and undulate margins; blades usually reddish-maculate on the lower surface ..... *Philodendron ligulatum* var. *heraclioanum*
75′. Petioles subterete lacking winged margins; blades never reddish-maculate ..... *Philodendron pseudauriculatum*

76. Appressed-climbing plants; stems drying yellowish and sulcate or green and finely striated; peduncle >3 cm long ..... 77
76′. Scandent-climbing plants; stems drying blackish or brownish-yellow and sulcate; peduncle usually <3 cm long ..... 79

77. Stem drying green and finely striated; dry blades usually granular on upper surface, primary lateral veins inconspicuous ..... *Philodendron ensifolium* subsp. *ensifolium*
77′. Stem drying yellowish and coarsely sulcate; dry blades usually minutely alveolate on the upper surface; primary lateral veins prominent on at least one of the surfaces ..... 78

78. Unsheathed portion of the petiole <1.0 cm long; petiole sheaths horizontally winged, widely open; seeds semi-coiled to cochlear ..... *Philodendron sulcatum*
78′. Unsheathed portion of petiole >1.0 cm long; petiole sheaths generally erect; seeds straight to slightly curved ..... *Philodendron opacum*

79. Petiole sheaths horizontally winged, widely open ... *Philodendron tuerckheimii*
79′. Petiole sheaths usually erect to involute ..... 80

80. Stems and petioles with the epidermis abruptly scaly and fissured ..... *Philodendron ichthyoderma*
80′. Stems and petioles with crisp and/or smooth epidermis (sometimes slightly scaly), but not abruptly fissured ..... 81

81. Blades drying blackish, up to 30 cm wide ..... *Philodendron inaequilaterum*
81′. Blades drying green or reddish-brown, usually ≤14.0 cm wide ..... 82

82. Unsheathed portion of the petiole usually ≤0.3 cm long; blades drying reddish brown, tertiary veins inconspicuous ..... *Philodendron alliodorum*
82′. Unsheathed portion of the petiole usually >0.3 cm long; blades drying greenish, tertiary veins prominent on the upper surface ..... *Philodendron rayanum*

83. Plants with abundant milky sap; stamens fused as synandria ..... 84
83′. Plants usually with colorless or reddish sap (sometimes absent) (in *Philodendron albisuccus* it turns whitish when exposed to air); stamens free (often weakly fused at the base, but never in synandria) .... 85

84. Plants strictly terrestrial, caulescent; spathe tube green internally; berries free *Xanthosoma hammelii*
84′. Appressed-climbing plants; spathe tube red-purple internally; berries connate as syncarp ..... *Syngonium schottianum*

85. Blades with posterior ribs (fused basal veins) naked (no tissue to the outside of the rib)..... 86
85′. Blades with posterior ribs (fused basal veins) not naked (with tissue to the outside of the rib)..... 92

86. Cataphylls of the upper nodes of stem mostly deciduous (sometimes persistent in the second and third node, but the rest are completely deciduous)..... 87
86′. Cataphylls generally persistent in the upper nodes of stem, either intact or fibrous ..... 88

87. Plants robust with short and thick internodes (1.5–2.0 × 4.5–10.0 cm); blades massive (55–95 × 36–90.0 cm) with broadly crenate margins..... *Philodendron* sp. 1
87′. Plants of medium size with elongated and slender internodes (3.0–15.0 × 1.3–1.7 cm); blades relatively small (22.0–35.0 × 16.0–31.0 cm) with entire margins..... *Philodendron wilburii* var. *longipedunculatum*

88. Plants with colorless sap that turns whitish when exposed to air; blades drying green to greenish-yellow..... *Philodendron albisuccus*
88′. Plants with colorless or reddish sap (which does not turn whitish when exposed to the air) or absent; blades drying brown to reddish-brown, blackish or grayish to brownish-gray ..... 89

89. Blades drying brown to reddish-brown; spathe tube reddish to purple-red on both surfaces..... 90
89′. Blades drying blackish, greenish-brown to grayish-brown; spathe tube greenish to grenish-white internally and greenish to greenish-yellow externally..91

90. Petioles D-shaped in cross section, with obtuse to acute margins; basal veins generally 3–5 pairs; primary lateral veins 3–6 per side..... *Philodendron fragrantissimum*
90′. Petioles terete or subterete, with rounded to obtuse margins; basal veins usually 7–11 pairs; primary lateral veins 6–10 per side ..... *Philodendron pirrense*

91. Blades ovate to broadly ovate, usually equal to or 1.5 times longer than wide; primary lateral veins 3–4 per side..... *Philodendron lazorii*
91′. Blades markedly ovate, usually 1.8 times longer than wide; primary lateral veins 4–7 per side..... *Philodendron panamense*

92. Cataphylls generally persistent on the upper nodes of stem, either intact or fibrous..... 93
92′. Cataphylls mostly deciduous on the upper nodes of stem (sometimes persistent in the second and third node, but the rest are totally deciduous)..... 95

93. Plants strictly terrestrial; petioles D-shaped in cross section, with elevated and acute margins; spathe tube green-whitish internally..... *Philodendron grandipes*
93′. Plants terrestrial or nomadic vines; petioles terete or subterete; spathe tube violet-purple or red-purple internally ..... 94

94. Midrib with purple spots on the lower surface (when fresh); basal veins 3–4 pairs; primary lateral veins usually 5–6 per side..... *Philodendron edenudatum*
94′. Midrib lacking purple spots (when fresh); basal veins >4 pairs; primary lateral veins usually >8 per side ..... *Philodendron tenue*

95. Petioles dorsiventrally flattened (sometimes with sharp lateral margins)..... *Philodendron platypetiolatum*
95′. Petioles terete to subterete, not dorsiventrally flattened..... 96

96. Posterior lobes of the blade usually overlapped; peduncles slender (2.0–4.0 mm diam.)..... *Philodendron clewellii*
96′. Posterior lobes of the blade never overlapped; peduncles thick (5.0–18.0 mm diam.) ..... 97

97. Blades usually 1.3–1.8 times longer than wide; sinus hypocrepiform; primary lateral veins usually up to 3 per side ..... *Philodendron purpureoviride*
97′. Blades usually ≥1.8 times longer than wide; sinus usually V-shaped; primary lateral veins 4–9 per side..... *Philodendron sagittifolium*

***Adelonema panamense*** Croat & Mansell (Fig. 2B)

**Material examined.** Cerro Pirre, 17 km S of El Real, along trail from base camp, along Río Perisenico; 08°01′N, 077°44′W; 100 m; 28 Jul. 1994; *T.B. Croat 77174* (MO). Campamento Rancho Frío, cercano a la loma ensucia pecho; 07°59′49″N, 077°42′45″W; 636 m; 2 Aug. 2016; *O.O. Ortiz 2665* (MO, PMA).

**Identification.** *Adelonema panamense* is easily recognized by having armed petioles, peltate leaves and puberulent, ovate-cordate, glossy blades, and a prominently white midrib on the upper surface. The specimen *Croat 77174* (MO) was previously identified as *A. wendlandii*; but the latter species differs in having basifixed leaves, matte blades and concolor midrib on the upper surface.

**Distribution and ecology.** Panama (endemic). In the study area, it generally grows in primary forests, below 700 m, in very humid and shady areas near streams.

***Adelonema wendlandii*** (Schott) S.Y. Wong & Croat (Fig. 2A)

**Material examined.** Cerro Pirre, Rancho Frío, cerca de la estación de la antigua ANAM; 08°01′16″N, 077°44′04″W; 103 m; 17 Apr. 2016; *O.O. Ortiz 2598* (MO, PMA).

**Identification.** This species is characterized by having armed and puberulent petioles, puberulent blades on the lower surface and segmented spadices with naked

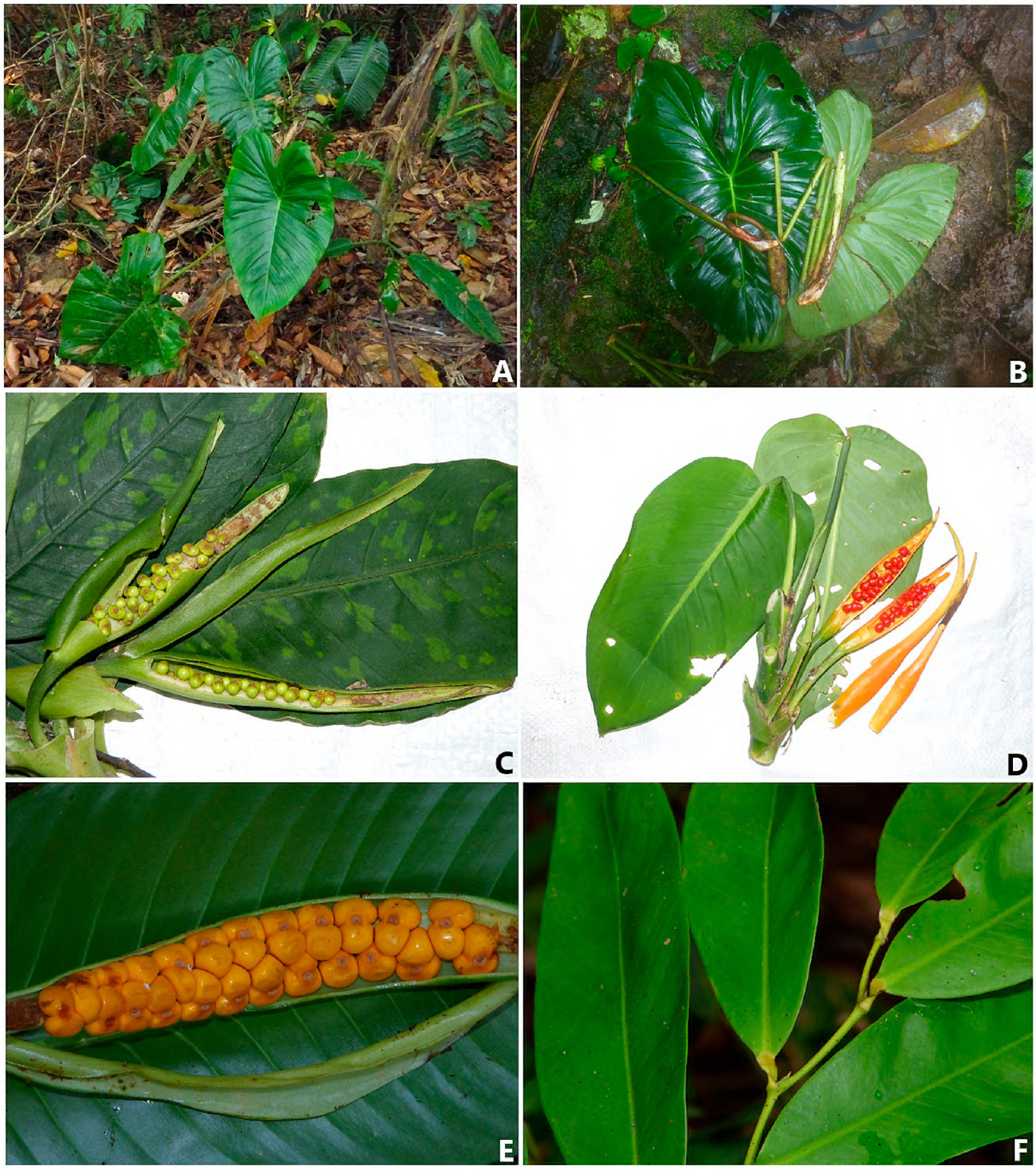


**Figure 2.** Some aroids from Cerro Pirre. **A.** *Adelonema wendlandii*. **B.** *Adelonema panamense*. **C.** *Dieffenbachia killipii* (infructescence). **D.** *Dieffenbachia isthmia* (infructescence). **E.** *Dieffenbachia longispatha* (infructescence). **F.** *Heteropsis oblongifolia.*

unisexual flowers. In the field it can be confused with *Adelonema panamensis* (see notes on this species) and with *Philodendron grandipes* K. Krause, but the latter species differs in having glabrous unarmed petioles, glabrous blades (on both surfaces) and prominent cataphylls.

**Distribution and ecology.** Central America and Colombia (Croat unpublished data). On Cerro Pirre, the species ocurrs in semideciduous forests (below 500 m), in open areas exposed to the sun. It is highly abundant on the banks of rivers and streams.

***Anthurium brownii*** Mast.

**Material examined.** Cerro Pirre, campamento Rancho Frío, cercano a la loma ensucia pecho; 07°59′49″N, 077°42′45″W; 636 m; 2 Aug. 2016; *O.O. Ortiz 2667* (PMA).

**Identification.** This species is easily recognized by its epiphytic habit, persistent fibrous cataphylls, cordate to hastate-trilobate blades, usually with undulate margins and lilac spadices. In the field, it can be confused with *Anthurium* sp. 2, but differs in having larger blades, green cucullate spathes, and yellow spadices.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Panama, and Venezuela. In the study area, this species grows at mid-elevation (500– 700 m) areas in evergreen forests. It is relatively abundant and can grow occasionally as terrestrial (falling from trees), but is usually epiphytic.

***Anthurium cerropirrense*** Croat (Fig. 3A, B)

**Material examined.** Cerro Pirre, Rancho Carajo hacia Cima, Serranía del Pirre, PN Darién, Bosque nuboso; 07°59′21″N, 077°42′26″W; 1129 m; 22 Apr. 2016; *J.E. Batista 1614* (MO, PMA). Cerro Pirre; 07°52′N, 077°44′W; 11 Apr. 1967; *N. Bristan 619* (MO). Along steep narrow ridge from Alturas de Nique to Cerro Pirre, ca 9–10 km due N of Alturas de Nique, ca 8 km W of Cana gold mine, virgin cloud forest, lower montane rain forest (Holdrige Life Zone System); 07°49′N, 077°43′ W; 1520–1560 m; 27 Jul. 1976; *T.B. Croat 37857* (MO). Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68948* (MO). Ibid.; 07°56′ N, 077°45′ W; 800–1050 m; *T.B. Croat 68949* (MO). Cerro Pirre, cloud forest and/or mossy forest; 07°50′N, 077°44′W; 9–10 Aug. 1967; *J.A. Duke E13822* (MO). Ibid.; 07°51′N, 077°44′W; Oct. 1962; *J.A. Duke 6094* (MO). Valley between between Pirre and next most southernly peak, sloping hillside; 07°40′N, 077°42′W; 1250–1300 m; 10–20 Jul. 1977; *J.P. Folsom 4421* (MO). Ibid.; *J.P. Folsom 4504* (MO). Serranía de Pirre, vicinity of Cerro Pirre; 07°52′N, 077°46′W; 1300–1500 m; 2 Jan. 1979; *R.L. Hartman 8553* (MO). Ibid., on trail immediately SE of summit; 07°52′N, 077°48′W; 1400 m; 14 Jul. 1977; *R.L. Hartman 4587* (MO). Ibid., trail ca 1 mi. SSW of Cerro Pirre summit; 07°56′ N, 077°42′ W; 1200 m; 15 Jul. 1977; *R.L. Hartman 4688* (MO). Ibid., on main ridge from intersection of trail down to Rancho Frío to 1 mi. S of that point, mossy cloud forest; 08°01′N, 077°43′W; 900–1000 m; 12 Jul. 1977; *R.L. Hartman 4533* (MO). Ibid., 1.5–2.5 mi. S on ridge from intersection with trail down to Rancho Frío, cloud forest; 07°57′N, 077°43′W; 900–1000 m; 11 Jul. 1977; *R.L. Hartman 4477* (MO). Ibid., main ridge 1–2 mi. N of Cerro Pirre; 07°56′N, 077°42′W; 1100–1200 m; 8 Jan. 1979; *R.L. Hartman 8604* (MO). Ibid., steep SE slope of Cerro Pirre, along newly cut trail to Boca de Cupe, within 500 altitudinal feet of summit, cloud forest; 07°56′N, 077°42′W; 1200 m; 3 Jan. 1979; *R.L. Hartman 8567* (MO). Ibid., wet forest; 07°56′N, 077°42′W; 1000–1080 m; 14 Sept. 1989; *G. McPherson 14085* (MO). Ibid., Rancho Plástico; 07°58′07″N, 077°42′26″W; 1208 m; 1 Aug. 2016; *O.O. Ortiz 2661* (MO, PMA). Ibid.; 07°58′57″ N, 077°42′30″ W; 1128 m; 18 Jul. 2016; *O.O. Ortiz 2731* (MO, PMA).

**Identification.** *Anthurium cerropirrense* is distinguished by having an elongated stem with short internodes, deciduous semi-intact cataphylls, narrowly elliptical to lanceolate blades with collective veins that emerge from one of the primary lateral veins, red-purple spadices, and elongated lilac berries. Croat (1986b) reported greenish spadices, but this species really has red-purple spadices at anthesis. At the study area, *A. cerropirrense* may be confused with *A. talamancae* Engl., but the latter species differs in having wider blades, cordate to subcordate at the base and three to four pairs of basal veins.

**Distribution and ecology.** This endemic species is found only in the cloud forests that are above 1100 m. It usually grows in the lower strata of the host trees, between 3 and 4 m above the forest floor. It is a rare species and can be seen sporadically along the edge of the mountain range.

***Anthurium clavigerum*** Poepp. & Endl.

**Material examined.** Parque Nacional Darién, Cerro Pirre, Rancho Frío; 08°01′16″N, 077°44′04″W; 103 m; 13 Apr. 2016; *O.O. Ortiz 2548* (PMA).

**Identification.** This species is notable by having large pedatisect leaves, with sinuate margins and for its huge pendant inflorescence. This *Anthurium* has the largest leaves in comparison with the rest of the Central American species (Croat 1983). They can be confused with sympatric *A. pentaphyllum* var. *bombacifolium* (Schott) Madison and *A. kunthii* Poepp., but both differ by having slender stems, smaller leaves with entire or subauriculate lobes (never markedly sinuate).

**Distribution and ecology.** Belize, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, Guyana, French Guiana, Honduras, Nicaragua, Panama, Peru, and Venezuela. *Anthurium clavigerum* represents a species of wide distribution. On Cerro Pirre, it grows along the lowland semideciduous forest and in mid-elevation evergreen forests, between 90 and 800 m. It is very common to observe adult individuals on trees associated with the banks of rivers and streams.

***Anthurium crassitepalum*** Croat

**Material examined.** Along path on ridgetop of/to Cerro Pirre from base camp called Rancho Plastico; 07°51′N, 077°42′W; 1100–1200 m; 1 Jul. 1980; *J.P. Folsom 8576* (MO). Parque Nacional Darién, Cerro Pirre; 07°46′00″N, 077°44′06″W; 1600 m; 12 May 1999; *A. Zapata 1541* (PMA).

**Identification.** This species is distinguished by its oblong-elliptic and glandular-punctate blades, as well as by its yellow-greenish spadices with thickened tepals. On Cerro Pirre, *A. crassitepalum* is very similar to *A. terryae* Croat, but the latter species differs by its very short petioles and flowers lacking thickened tepals.

**Distribution and ecology.** This species is endemic to the Darien Province. In the study area, it is found only in cloud forests that are above 1100 m. During the samplings, no individuals of this species were observed.

***Anthurium crystallinum*** Linden & André (Fig. 3C)

**Material examined.** Middle slopes on W side of Cerro

**Figure 3.** Some aroids from Cerro Pirre. **A.** *Anthurium cerropirrense* (inflorescence). **B.** *Anthurium cerropirrense* (infructescence). **C.** *Anthurium crystallinum* (inflorescence). **D.** *Anthurium cucullispathum* (inflorescence). **E.** *Anthurium cuspidatum* (inflorescence). **F.** *Anthurium cuspidatum* (infructescence). **G.** *Anthurium hartmanii* (inflorescence). **H.** *Anthurium lancifolium* (inflorescence). **I.** *Anthurium michelii* (infructescence).

Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68852* (MO). Cerro Pirre, ridgetop and slope from Rancho Frío to Rancho Plastico; 08°01′N, 077°42′W; 800–1200 m; 10–20 Jul. 1977; *J.P. Folsom 4206* (MO). Ibid., valley between between Pirre and next most southernly peak, sloping hillside; 07°40′N, 077°42′W; 1250–1300 m; 10–20 Jul. 1977; *J.P. Folsom 4449* (MO). Base of Cerro Pirre near Piji Vasal; 08°03′N, 077°43′W; 21 Oct. 1977; *J.P. Folsom 77-436* (MO). Along path on ascending ridge to Cerro Pirre from Prijivasal, below

600 m site known as Rancho Frio, tall forest, but north lowland type; 07°57′N, 077°42′W; 600 m; 29 Jun. 1980; *J.P. Folsom 8516* (MO). Parque Nacional Darién, Serranía de Pirre, campamento Rancho Frío, cercano a la loma ensucia pecho; 07°59′49″ N, 077°42′45″ W; 636 m; 2 Aug. 2016; *O.O. Ortiz 2664* (PMA). Ibid., campamento cerca del segundo mirador; 07°59′43″ N, 077°42′39″ W; 708 m; 3 Dec. 2016; *O.O. Ortiz 2711* (PMA), Ibid.; 07°59′49″ N, 077°42′43″ W; 610 m; 19 Jul. 2016; *O.O. Ortiz 2724* (PMA).

**Identification.** This species is distinguished by its terrestrial habit and dark velvety-green blades with the midrib and basal veins whitish, as well as its yellow spadices and reddish reflexed spathes. Due to the combination of the latter characters, this species can not be confused with any of its congeners present on Cerro Pirre.

**Distribution and ecology.** Although this species is commonly cultivated as ornamental, it appears to have a restricted distribution range, because it grows naturally only in Panama and Colombia (Croat 1986b; TROPICOS 2018). The known Panamanian populations are located exclusively in the Serranía de Pirre. During the fieldtrips, it was observed that this species grows only in the evergreen forests of Cerro Pirre, between 600 and 700 m. It is associated with shady places with extremely steep slopes in well drained soils.

***Anthurium cucullispathum*** Croat (Fig. 3D)

**Material examined.** Parque Nacional Darien, middle slopes on W side of Cerro Pirre; 07°56′N, 077°43′W; 800–1050 m; 30 Jun. 1988; *T.B. Croat 68700C* (MO). Cerro Pirre, cloud forest and/or mossy forest; 07°50′N, 077°44′W, 762–1370 m, 9–10 Aug. 1967; *J.A. Duke E13800* (MO). Parque Nacional del Darién, estación Rancho Frío at N base of Cerro Pirre, ca 9 km S of El Real, along Quebrada Perisenico, in forest; 08°01′N, 077°44′W; 70–270 m; 8 Oct. 1987; *B.E. Hammel 16112* (MO). Serranía de Pirre, trail ca 1 mi. SSW of Cerro Pirre summit; 07°56′N, 077°42′W; 1200 m; 15 Jul. 1977; *R.L. Hartman 4685* (MO). Parque Nacional Darién, Cerro Pirre, Rancho Frío, cascada arriba; 08°00′58″ N, 077°43′24″ W; 164 m; 14 Apr. 2016; *O.O. Ortiz et al. 2569* (PMA). Ibid., Rancho Plástico, camino hacia la cima del Cerro; 07°59′49″ N, 077°42′45″ W; 636 m; 15 Apr. 2016; *O.O. Ortiz 2579* (PMA). Ibid., Rancho Plástico; 07°59′13″ N, 077°42′28″ W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2630* (PMA). Ibid., Rancho Frío, orillas del río Perresenico; 08°01′11″ N, 077°43′51″ W; 110 m; 1 Dec. 2016; *O.O. Ortiz 2699* (PMA).

**Identification.** This species is characterized by having intact and persistent cataphylls, narrowly ovate to ovate-triangular (more than twice as long as wide) and moderately coriaceous blades; creamy-white spadices and cucculate spathes. Some specimens had inusual larger blades, *Croat 68700C* (35.9 × 6.0 cm), *Hammel 16112* (41.0 × 7.0 cm), and *Hartman 4685* (31.5 × 7.5 cm); however, the floral characteristics are similar to the rest of the specimens. At the study site, *A. cucullispathum* may be confused with juvenile individuals of *A. ravenii* Croat & R.A. Baker and *Anthurium* sp. 4, but both species differs due to the deciduous cataphylls in most of the nodes and by its reflexed and brittle spathes.

**Distribution and ecology.** Colombia, Costa Rica, and Panama. On Cerro Pirre, this species generally grows in low and mid elevation areas, in the semideciduous and evergreen forests, below 1000 m.

***Anthurium curvispadix*** Croat

**Material examined.** Cerro Pirre, Rancho Carajo hacia Cima, Serranía del Pirre, PN Darién, Bosque nuboso; 07°59′21″N, 077°42′26″W; 1129 m; 22 Apr. 2016; *J.E. Batista 1615* (PMA). Cerro Pirre; 07°52′N, 077°44′W; 11 Apr. 1967; *N. Bristan 492* (MO). Parque Nacional Darién, Cerro Pirre, Rancho Frío, cascada arriba; 08°00′58″N, 077°43′24″W; 164 m; 14 Apr. 2016; *O.O. Ortiz 2562* (MO, PMA). Ibid., campamento cerca del segundo mirador; 07°59′43″ N, 077°42′39″W; 708 m; 2 Dec. 2016; *O.O. Ortiz 2702* (PMA). Ibid.; 07°59′49″ N, 077°42′43″ W; 610 m; 19 Jul. 2016; *O.O. Ortiz 2727* (PMA).

**Identification.** This species is distinguished by its widely ovate to ovate-triangular, coriaceous blades, creamy-white spadices, and greenish-white reflexed spathes. Additionally, *Anthurium curvispadix* has very long cataphylls (up to 18 cm long). The closest species to *A. curvispadix* on Cerro Pirre is *A. cucullispathum* Croat, but the latter species has smaller cataphylls, blades usually more than twice as long as wide and erect-cucculate spathes.

**Distribution and ecology.** This species is currently endemic to Panama. On Cerro Pirre it grows generally in the mid-elevation evergreen forests (between 500 and 800 m). Sporadic individuals of this species can be observed in tree branches at 10–20 m.

***Anthurium cuspidatum*** Mast. (Fig. 3E, F)

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68938* (MO). Cerro Pirre, cloud forest and/or mossy forest; 07°50′N, 077°44′W; 760–1300 m; 9–10 Aug. 1967; *J.A. Duke 13821* (MO). Ibid., ridgetop and slope from Rancho Frío to Rancho Plástico; 08°01′N, 077°42′W; 800–1200 m; 10–20 Jul. 1977; *J.P. Folsom 4207* (MO). Summit of Cerro Pirre, cloud forest; 07°55′21″N, 077°42′57″W; 1000–1400 m; 29 Dec. 1972; *A.H. Gentry 7031* (MO). Ibid., N end of range, 2–3 mi. N of Cerro Pirre; 07°56′N, 077°42′W; 1000–1100 m; 30 Dec. 1978; *R.L. Hartman 8509* (MO). Parque Nacional Darién, caminando entre Campamento Rancho Frío No. 2 hacia la cima de Cerro Pirre; 08°00′N, 077°45′W; 700–1000 m; 7 Feb. 1991; *H. Herrera 870* (MO). South of El Real on trail up Cerro Pirre, forest; 08°00′N, 077°45′W; 550–1030 m; 29 Mar. 1985; *G. McPherson 7002* (MO).

Parque Nacional Darién, Serranía de Pirre, Rancho Plástico; 07°59′13″ N, 077°42′28″ W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2644* (PMA).

**Identification.** According to Croat and Ortiz (2016), *Anthurium cuspidatum* Mast. is characterized by its usually terrestrial habit, short internodes, persistent cataphylls as fibers, broadly ovate blades wich drying greenish, six to nine pairs basal veins (one to three free from each other) and purple to dark-purple spadices.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, and Panama. On Cerro Pirre this species generally grows in cloud forests, which are located above 1000 m. This species frequently presents terrestrial habit, but in places with abundant humidity and mosses, it can grow as an epiphyte.

***Anthurium dukei*** Croat

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68865* (MO). Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68955* (MO). Ibid.; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68956* (MO). Cerro Campamento (south of Cerro Pirre), cloud forest; 07°47′N, 077°43′W; 20–22 Mar. 1968; *J.A. Duke 15572* (MO). Ibid.; 07°47′N, 077°43′W; 20–22 Mar. 1968; *J.A. Duke 15699* (MO). Cerro Pirre, ridge top near Rancho Plastico; 07°57′N 077°42′W; 1200 m; 10–20 Jul. 1977; *J.P. Folsom 4232* (MO). Ibid., valley in between Pirre and mountain directly south; 07°40′N, 077°42′W, 10–20 Jul. 1977; *J.P. Folsom 4365* (MO). Ibid.; *J.P. Folsom 4459* (MO). Ibid., top of mountain and ridge just south of Pirre, visible from Pirre clearing; 07°40′N, 077°44′W; 10–20 Jul. 1977; *J.P. Folsom 4517* (MO). Ridgetop area N of Cerro Pirre, between Cerro Pirre top and Rancho Plastico; 07°51′N, 077°42′W; 1200–1400 m; 14 Nov. 1977; *J.P. Folsom 6320* (MO). Summit of Cerro Pirre; 07°52′00″N, 077°42′30″W; 1000 m; 8 Mar. 1972; *A.H. Gentry 4595* (MO). Serranía de Pirre, trail ca 1 mi. N of Cerro Pirre, on main ridge; 07°56′N, 077°42′W; 1200 m; 14 Jul. 1977; *R.L. Hartman 4593A* (MO). Ibid., on deforested summit; 07°52′N, 077°46′W; 1500 m; 23 Jul. 1977; *R.L. Hartman 4812* (MO). Parque Nacional Darién, caminando entre Capamento Rancho Frío No. 2 hacia la cima de Cerro Pirre; 08°00′N, 077°45′W, 700–1000 m; 7 Feb. 1991; *H. Herrera 872* (MO). Ibid., Rancho Plástico; 07°58′54″ N, 077°42′30″ W; 1128 m; 31 Jul. 2016; *O.O. Ortiz 2656* (PMA).

**Identification.** This species is characterized by its epiphytic habit, thick stems (2.5 cm diam.), short internodes, persistent and semi-intact large cataphylls, narrowly ovate-triangular large blades wich drying greenish, ridged petioles, numerous primary lateral veins (12 to 20 per side), 6 to 8 pairs of basal veins, lanceolate spathes and red berries. Some specimens were erroneously identified in the past as *Anthurium caperatum* Croat & R.A. Baker (see Croat 1986b); however, the latter species differs in having broadly ovate blades and green to pale yellow berries. In the field, this species can be confused with the sympatric *A. niqueanum* Croat, but differs in having slender stems (up to 1 cm diam.), long internodes and markedly bullate blades.

**Distribution and ecology.** *Anthurium dukei* represents an endemic species of the Serranía de Pirre. In the study area, its distribution is restricted to montane cloud forests, located above 1100 m. This species is relatively abundant and usually grows in the lower strata at 3–5 m.

***Anthurium friedrichsthalii*** Schott

**Material examined.** Río Pirre; 07°55′N, 077°44′W; 14 Jul. 1971; *T.B. Croat 15512* (MO, PMA). Camino del Pirre; 07°52′N, 077°44′W; 8 Jul. 1966; *J.A: Duke 254* (MO, PMA). Parque Nacional Darién, vecindad de la Estación Pirre, en la trocha limitrofe entre el camino a Cerro Pirre y Balsas; 08°00′N, 077°45′W; 60–150 m; 12 Feb. 1991; *H. Herrera 957* (MO). South of El Real, headwaters of Rio Pirre at fork known as Dos Bocas; 08°01′N, 077°44′W; 100 m; 25 Sept. 1969; *H. Kennedy 2823* (MO, PMA).

**Identification.** *Anthurium friedrichsthalii* is characterized by its epiphytic habit, pendant leaves, black-glandular punctate (only on the lower surface), linear blades, relatively short petioles and yellow-orange berries. In the study area, *A. friedrichsthalii* can be confused with *A. pendens* Croat, but the latter differs by having blades drying blackish, black-glandular punctate on both surfaces and flowers with all stamens exposed (when dry).

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Nicaragua, and Panama. On Cerro Pirre, this species is generally found at areas below 800 m, along the semi-deciduous and evergreen forests. It is usual to observe the individuals of this species in the highest branches of the host trees (near the forest canopy), approximately at 15–20 m.

***Anthurium hartmanii*** Croat & O. Ortiz (Fig. 3G)

**Material examined.** Cerro Pirre, Rancho Carajo, Serrania del Pirre, PN Darién, Bosque ruboso; 07°57′11″N, 077°42′15″W; 1261 m; 21 Apr. 2016; *J.E. Batista 1607* (MO, PMA). Cerro Pirre, collection from area around the camp at top of Pirre, near triangualtion marker; 07°52′00″N, 077°43′30″W; 1400 m; 10–20 Jul. 1977; *J.P. Folsom 4348* (MO). Ridgetop area N of Cerro Pirre, between Cerro Pirre top and Rancho Plastico; 07°51′N, 077°42′W; 1200–1400 m; 14 Nov. 1977; *J.P. Folsom 6303* (MO). Along path on ascending ridge to Cerro Pirre from Pijibasal, nearly vertical ascent from Rancho Frio to ridgetop grade running to Rancho Plastico; 07°51′N, 077°42′W; 600–1100 m; 30 Jun 1980; *J.P. Folsom 8544* (MO). Serranía de Pirre, trail ca 1 mi. N of Cerro Pirre, on main ridge; 07°56′N, 077°42′W; 1200 m; 14 Jul. 1977; *R.L. Hartman 4596* (MO). Ibid., steep SE slope of Cerro Pirre,

along newly cut trail to Boca de Cupe, within 500 altitudinal feet of summit, cloud forest; 07°56′N, 077°42′W; 1200 m; 3 Jan. 1979; *R.L. Hartman 8566* (MO). Parque Nacional Darién, camino a Cerro Cituro desde el Campamento de Cana; *J. Polanco 2894* (PMA). Parque Nacional Darien, Cerro Pirre; 07°46′00″N, 077°44′06″W; 1600 m; May 1999; *A. Zapata 1542* (MO). Ibid.; 07°46′00″N, 077°44′06″W; 1400 m; 12 May 1999; *A. Zapata 1588* (MO). Ibid., Rancho Plástico; 07°58′57″ N, 077°42′30″ W; 1128 m; 18 Jul. 2016; *O.O. Ortiz 2733* (PMA).

**Identification.** In the revision of *Anthurium* of Panama (Croat 1986), *A. erythrostachyum* Croat was described, based on a collection (holotype) made in Alturas del Nique (extreme south of the Serranía de Pirre) and some collections (paratypes) of Cerro Pirre (extreme north of the Serrania de Pirre). Subsequently, Croat et al. (2017a) using the specimens of Cerro Pirre (previously determined as *A. erythrostachyum*), described *A. hartmanii* Croat & O. Ortiz as a different species. This latter species occurs only at Alturas del Nique and is characterized by its nomadic vine life form, elongated internodes, persistent intact cataphylls, terete petioles, blades with two to four pairs of basal veins, and three to four pairs of primary lateral veins, as well as its greenish white spathes and lavender spadices. In the field, this species is very similar to *A. rubrifructum* Croat, but this latter has thin and deciduous cataphylls, triangular-hastate blades and greenish reflexed spathes.

**Distribution and ecology.** Endemic to Panama. So far, it is known to be distributed only along the cloud forests located north of the Serranía de Pirre. Apparently, this species has preferences to relatively open sites with greater light intensity. Croat et al. (2017a) report that *A. hartmanii* presents terrestrial habit; however, the observations made in the field indicate that it has a nomadic vine life form. This species germinates in the soil and then climbs to the hosts (usually small trees), usually up to 2–3 m.

***Anthurium interruptum*** Sodiro

**Material examined.** Cerro Campamento (south of Cerro Pirre), cloud forest: 07°47′N, 077°43′W; 20–22 Mar. 1968; *J.A. Duke 15714* (MO).

**Identification.** *Anthurium interruptum* is characterized by its epiphytic-climbing habit, stems with elongate internodes, lanceolate to elliptical, oblong-elliptic or oblanceolate blades, brownish-black (when dry), and reddish berries. On Cerro Pirre, the most similar to *A. interruptum* is *Anthurium* sp. 1, but the latter differs in having shorter internodes, chartaceous and yellowish blades.

**Distribution and ecology.** Belize, Bolivia, Colombia, Costa Rica, Ecuador, Guatemala, Nicaragua, and Panama. Croat (1983) mentioned that *A. interruptum* is a very common species in lowland areas between 100 and 1000 m (Croat 1983). However, during the sampling at Cerro Pirre no individual was observed.

***Anthurium kunthii*** Poepp.

**Material examined.** Vicinity Cerro Pirre, along trail from base camp to Rancho Frío on slopes of Cerro Pirre; 07°58′N, 077°43′W; 200–450 m; 27 Jul. 1994; *T.B. Croat 77122* (MO). Eastern slope of Cerro Pirre, climbing up from Cana; 07°44′N, 077°41′W; 500–1000 m; 23 Sept. 1982; *C. Hamilton 1502* (MO). Parque Nacional Darién, trocha limitrofe del parque, vecindad de la Estación Pirre; 08°00′N, 077°45′W; 50–100 m; 9 Feb. 1991; *H. Herrera 912* (MO, PMA).

**Identification.** This species is characterized by having slender stems, elongate internodes, fibrous cataphylls, palmately-compound leaves, leaflets with entire margins, long and slender peduncles that almost equal petioles in length, and greenish tapered spadices. In the study area it can be confused with *A. pentaphyllum* var. *bombacifolium* (Schott) Madison, but this species differs in having subauriculate basal leaflets, inflorescences with short peduncles and grayish to violet spadices.

**Distribution and ecology.** Bolivia, Brazil, Colombia, Costa Rica, Ecuador, Panama, Peru, and Venezuela. This species of widespread distribution commonly grows along the semideciduous to evergreen forests of Cerro Pirre, generally between 90 and 700 m.

***Anthurium lancifolium*** Schott (Fig. 3H)

**Material examined.** Cerro Pirre, Rancho Plástico, Serranía del Pirre, PN Darién, bosque nuboso; 07°59′23″ N, 077°42′28″ W; 1077 m; 20 Apr. 2016; *J.E. Batista 1576* (PMA). Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68947* (MO). Rancho Frío (500 m) to summit of Cerro Pirre (1140 m); 07°51′N, 077°42′W; 500–1140 m; 30 March 1985; *W.G. D'Arcy 16186* (MO). Cerro Pirre, cloud forest and/or mossy forest; 07°50′N, 077°44′W; 760–1370 m; 9–10 Aug. 1967; *J.A. Duke 13739* (MO). Ibid., ridge top near Rancho Plastico; 07°57′N, 077°42′W; 1200 m; 10–20 Jul. 1977; *J.P. Folsom 4268* (MO). Area from below Rancho Frío to near ridgetop of Pirre chain; 07°57′N, 077°42′W; 600–1100 m; 15 Nov. 1977; *J.P. Folsom 6355* (MO, PMA). Along path on ridgetop of/to Cerro Pirre from base camp called Rancho Plastico (1100 m); 07°51′N, 077°42′W; 1100–1200 m; 1 Jul. 1980; *J.P. Folsom 8577* (MO). Summit of Cerro Pirre, cloud forest; 07°55′21″N, 077°42′57″W; 1000–1400 m; 29 Dec. 1972; *A.H. Gentry 7030* (MO). Ibid.; 07°55′21″N, 077°42′57″W; 1000–1400 m; 29 Dec. 1972; *A.H. Gentry 7103* (MO). Slopes of Cerro Pirre; 07°57′N, 077°42′W; 500–1000 m; 30 Dec. 1972; *A.H. Gentry 7149* (MO). Serranía Pirre, 1–1.5 mi. S on ridge from intersection with trail to Rancho Frío; 08°00′N, 077°44′W; 900 m; 10 Jul. 1977; *R.L. Hartman 4464* (MO, PMA). Ibid., trail ca 1 mi. SSW of Cerro Pirre summit; 07°56′N, 077°42′W; 1200 m; 15 Jul. 1977;

*R.L. Hartman 4694* (MO). Parque Nacional Darién, caminando entre Campamento Rancho Frío No. 2 hacia la cima de Cerro Pirre; 08°00′N, 077°45′W; 700–1000 m; 7 Feb. 1991; *H. Herrera 873* (MO). Ibid.; 08°00′N, 077°45′W; 700–1000 m; 7 Feb. 1991; *H. Herrera 876* (MO). Ibid., Cerro Pirre; 07°52′N, 077°43′W, 1000–1060 m; 7 Feb. 1991; *H. Herrera 884* (MO). South of El Real on trail up Cerro Pirre, forest; 08°00′N, 077°45′W; 550–1030 m; 29 Mar 1985; *G. McPherson 7047* (MO). North slopes of Cerro Pirre, lower montane rain forest (cloud forest); 07°54′N, 077°42′W; 700–950 m; 7 Apr. 1975; *S. Mori 5472* (MO). Parque Nacional Darién, Cerro Pirre, Rancho Plástico, camino hacia la cima del Cerro; 07°59′49″ N, 077°42′45″ W; 636 m; 15 Apr. 2016; *O.O. Ortiz 2583* (PMA). Ibid.; 07°59′13″ N, 077°42′28″ W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2640* (PMA).

**Identification.** *Anthurium lancifolium* represents one of the most common species of the genus in Panama and is also one of the most morphologically variable (Croat 1986). This species is recognized by its habitually terrestrial habit, short stems with persistent fibrous cataphylls and dark glandular-punctacte blades on both surfaces. All the material examined from Cerro Pirre constitutes the typical variety *A. lancifolium* var. *lancifolium*. The other known variety, *A. lancifolium* var. *albifructum* Croat is differentiated by having white berries and is restricted to western Panama (Croat 1986). In the study area, *A. lancifolium* could be confused with *A. ramonense* Engl. ex K. Krause, but this latter species has blades with black glandular-punctate only on the lower surface and reddish spadices.

**Distribution and ecology.** Colombia, Costa Rica, Nicaragua and Panama. This species is widely distributed in Panama and grows in areas of low to mid-elevations (100–1600 m). On Cerro Pirre, it is highly common in the montane cloud forests. Usually, it has a terrestrial habit, but in places above 1100 m, it can grow occasionally as an epiphyte.

***Anthurium michelii*** Guillaumin (Fig. 3I)

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68897* (MO). Parque Nacional Darién, Cerro Pirre, campamento cerca del segundo mirador; 07°59′49″ N, 077°42′43″ W; 610 m; 19 Jul. 2016; *O.O. Ortiz 2726* (PMA).

**Identification.** *Anthurium michelii* is distinguished to have oblong-elliptical, discolor blades (pale-green on the lower surface when fresh), markedly stipitate spadices and purple berries. On Cerro Pirre, there is no species related to *A. michelii*; however, it could be confused with juvenile individuals of *A. salvinii* Hemsl. The latter species differs mainly in having cucculate cataphylls.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Panama and Peru. In the study site, it is usual to observe this species only in mid-elevation evergreen forests (between 600 and 800 m).

***Anthurium niqueanum*** Croat (Fig. 4A, B)

**Material examined.** Cerro Pirre, Rancho Carajo, Serranía del Pirre, PN Darién, bosque nuboso; 07°58′59″N, 077°42′29″W; 1118 m; 21 Apr. 2016; *J.E. Batista 1579* (PMA). Ibid.; 07°59′21″N, 077°42′26″W; 1118 m; 22 Apr. 2016; *J.E. Batista 1616* (PMA). Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68950* (MO). Cerro Pirre, ridge top near Rancho Plastico; 07°57′N, 077°42′W; 1200 m; 10–20 Jul. 1977; *J.P. Folsom 4303* (MO). Serranía de Pirre, N end of range, 2–3 mi. N of Cerro Pirre; 07°56′N, 077°42′W; 1000–1100 m; 29 Dec. 1978; *R.L. Hartman 8495* (MO). Parque Nacional Darién, caminando entre Campamento Rancho Frío No. 2 hacia la cima de Cerro Pirre; 08°00′N, 077°45′W; 700–1000 m; 7 Feb 1991; *H. Herrera 877* (MO). Ibid., Cerro Pirre; 07°46′N, 077°44′W, 1400 m, *A. Zapata 1587* (PMA). Ibid., Serranía de Pirre, Rancho Plástico; 07°59′13″N, 077°42′28″W; 1127 m; *O.O. Ortiz 2642* (MO, PMA).

**Identification.** This species is distinguished by its nomadic vine life form, elongated internodes, bullate blades, triangular or ovate-triangular with prominent veins on the lower dried surface. Croat (1986b) reports that this species has greenish spadices and unknown berries color; however, according to the observations in the field, this species has reddish spadices with prominent yellowish stamens at anthesis and whitish berries that turn red when they are mature. *Anthurium niqueanum* can be confused with juvenile individuals of *A. dukei* Croat, but the latter species is vegetatively differentiated by having very short internodes and markedly ribbed petioles.

**Distribution and ecology.** *Anthurium niqueanum,* known only from the Serranía de Pirre (endemic to Panama), occurs in montane cloud forests, above 1100 m. This species usually grows on shrubs or small trees, up to 5 m. It is common to observe several seedlings and juvenile individuals along the forest floor.

***Anthurium obtusum*** (Engl.) Grayum

**Material examined.** 1–5 mi. downstream from El Real; 08°05′N, 077°44′W; 30 Jun 1962; *J.A. Duke 4940* (MO).

**Identification.** This species is characterized by its elongated and slender stems with long internodes, persistent-fibrous cataphylls, black glandular-punctate blades and consistently erect spathes. In the study area, *A. obtusum* is similar to *A. scandens* subsp. Scheffer *pusillum*, but the latter has narrower leaves, very small spadices (ca 1.0 cm long) and reflexed spathes.

**Distribution and ecology.** Belize, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Guyana, French Guiana, Honduras, Mexico, Panama, Peru,

**Figure 4.** Some aroids from Cerro Pirre. **A.** *Anthurium niqueanum* (inflorescence). **B.** *Anthurium niqueanum* (infructescence). **C.** *Anthurium ochranthum* (inflorescence). **D.** *Anthurium panduriforme* (inflorescence). **E.** *Anthurium pirrense* (inflorescence). **F.** *Anthurium ramonense* (inflorescence). **G.** *Anthurium ravenii* (infructescence). **H.** *Anthurium rotundistigmatum* (inflorescence). **I.** *Anthurium rubrifructum* (infructescence).

Suriname, and Venezuela. On Cerro Pirre, this species is only known from a collection made in the semideciduous lowland forests. During the samplings, no individuals of this species were observed.

***Anthurium ochranthum*** K. Koch (Fig. 4C)

**Material examined.** Parque Nacional Darién, vicinity of Cerro Pirre base camp, along trail near E side of Río Paracida; 08°00′N, 077°48′W; 1 Jul. 1988; *T.B. Croat 68985* (MO). Vicinity Cerro Pirre, along trail from base camp to Rancho Frío on slopes of Cerro Pirre; 07°58′N, 077°43′W; 200–450 m; 27 Jul. 1994; *T.B. Croat 77121* (MO). Along path to Cerro Pirre ridge from Pijivasal, near El Real, lowland forest; 08°03′N, 077°43′W; 50 m; 29 Jun. 1980; *J.P. Folsom 8512* (MO). Río Pirre, trail up river from house of Bartolo; 07°55′N, 077°44′W; 16 Mar. 1973; *H. Kennedy 2891* (MO, PMA). Parque Nacional Darién, Cerro Pirre, Rancho Frío; 08°01′16″ N, 077°44′04″ W; 103 m; 13 Apr. 2016; *O.O. Ortiz 2549* (PMA). Ibid., camino hacia Rancho Plástico, despues del primer mirador; 08°00′57″N, 077°43′41″W; 157 m; 14 Apr. 2016; *O.O. Ortiz 2575* (PMA). Ibid., Rancho Frio, cerca de la estación de la antigua ANAM; 08°01′16″N, 077°44′04″W; 103 m; 17 Apr. 2016: *O.O. Ortiz 2595* (PMA).

**Identification.** This species is recognized by its terrestrial habit, short internodes, semi-intact and persistent cataphylls, yellow tapered spadices, and white berries with lilac apex. Based on the characteristics mentioned, there are no species similar to *A. ochranthum* in the study area. It could be confused with *A. dukei* Croat, but differs in having massive leaves, ribbed petioles and very long creamy-yellow cataphylls.

**Distribution and ecology.** Colombia, Costa Rica, Honduras, Nicaragua, and Panama. Compared with other terrestrial aroid species, *A. ochranthum* is possibly the most abundant in the semideciduous lowland forest of Cerro Pirre, but as elevation increases, its occurrence decreases. It is usual to observe this species along trails, rivers and streams, in shady places or in open areas.

***Anthurium panduriforme*** Schott (Fig. 4D)

**Material examined.** Cerro Pirre, Rancho Carajo, Serranía del Pirre, PN Darién, bosque nuboso; 07°58′59″N, 077°42′29″W; 1118 m; 21 Apr. 2016; *J.E. Batista 1578* (PMA). Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68918* (MO). Ridgetop area N of Cerro Pirre, between Cerro Pirre top and Rancho Plastico; 07°51′N, 077°42′W; 1200–1400 m; 14 Nov. 1977; *J.P. Folsom 6337* (MO). Summit of Cerro Pirre, cloud forest; 07°55′21″N, 077°42′57″W; 1000–1400 m; 29 Dec. 1972; *A.H. Gentry 7029* (MO). Parque Nacional Darién, caminando entre Campamento Rancho Frío No. 2 hacia la cima de Cerro Pirre; 08°00′N, 077°45′W; 700–1000 m; 7 Feb. 1991; *H. Herrera 858* (MO). Ibid., Cerro Pirre; 07°46′N, 077°44′W; 1600 m; 12 May 1999; *A. Zapata 1566* (PMA).

**Identification.** *Anthurium panduriforme* is characterized by its epiphytic habit, short internodes, fibrous, deciduous cataphylls in most nodes, bright-yellow (when dry) panduriform blades with almost orbicular posterior lobes, and yellow spadices. According to the characteristics mentioned, there are no similar species in the study area. However, herbarium specimens can be confused with those of *A. niqueanum* Croat, but the latter differs in having long internodes, bullate blades and reddish spadices.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, and Panama. This species of wide distribution is common in the submontane and montane forests of Cerro Pirre, usually in areas above 800 m. It is relatively common and usually grows on the lower branches of the host trees (between 2 and 5 m).

***Anthurium pendens*** Croat

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68887* (MO). Parque Nacional Darién, Cerro Pirre, campamento cerca del segundo mirador; 07°59′43″ N, 077°42′39″ W; 708 m; 2 Dec. 2016; *O.O. Ortiz 2701* (PMA).

**Identification.** This species is characterized by having pendent leaves, elongated, narrowly oblanceolate blades, acute at the base, black glandular-punctate on both surfaces and primary lateral veins emerging from the midvein at an angle of 10–20°. It is also distinguished by its erect, relatively short, and greenish-brown to pinkish spadix. *Anthurium pendens* can easily be confused with *A. friedrichsthalii* Schott, since both species have an epiphytic habit with pendulous leaves, linear blades and yellowish berries. *Anthurium friedrichsthalii* Schott differs mainly in having black glandular-punctate blades only on the lower surface.

**Distribution and ecology.** Colombia and Panama. The samplings and the few collections made of this species in the study area, indicate that it represents a rare species and so far it has only been recorded in the mid-elevation evergreen forests, between 600 and 800 m.

***Anthurium pentaphyllum*** var. ***bombacifolium*** (Schott) Madison

**Material examined.** Parque Nacional Darién, Cerro Pirre, Rancho Frío, cascada arriba; 08°00′58″N, 077°43′24″W; 164 m; 14 Apr. 2016; *O.O. Ortiz 2566* (PMA).

**Identification.** This taxon is characterized by having elongated stems with long internodes, usually deciduous cataphylls (sometimes persistent as fibers in the upper nodes), pedati-compound leaves with basal lobes subauriculate, short peduncles, white, greenish or grayish spadices, and reddish berries. By the resemblance in the leaves can be confused with *A. clavigerum* Poepp. and *A.*

*kunthii* Poepp. However, *A. pentaphyllum* var. *bombacifolium* differs from both species in having basal lobes sub-auriculate and short white-grayish spadices.

**Distribution and ecology.** Belize, Costa Rica, Guatemala, Honduras, Mexico, Nicaragua and Panama. On Cerro Pirre, *Anthurium pentaphyllum* var. *bombacifolium* is common in semideciduous forests. It usually grows on the buttress roots of the host trees, often close to the forest floor (between 3 to 5 m). As elevation increases, this species becomes less occasional. After 800 m no individual of this species was observed.

***Anthurium pirrense*** Croat (Fig. 4E)

**Material examined.** Serranía de Pirre, along steep narrow ridge from Alturas de Nique to Cerro Pirre, ca 9–10 km due N of Alturas de Nique, ca 8 km W of Cana gold mine, virgin cloud forest, lower montane rain forest (Holdrige Life Zone System); 07°44′N, 077°43′W; 1430–1480 m; 27 Jul. 1976; *T.B. Croat 37850* (MO). Ibid.; 07°49′N, 077°43′W; 1480–1520 m; *T.B. Croat 37884* (MO). Parque Nacional Darién, Serranía de Pirre, Rancho Plástico; 07°58′07″N, 077°42′26″W; 1208 m; 1 Aug. 2016; *O.O. Ortiz 2663* (MO, PMA).

**Identification.** *Anthurium pirrense* is distinguished by its epiphytic habit, short stems with persistent and fibrous cataphylls, subterete petioles, oblong-elliptic and subcoriaceous blades with the collective vein relatively separated from the margin. Also characteristic is its slender yellowish-brown spadices and the violet rings around the pistils. It can be confused with the sympatric *A. crassitepalum*, but this species comprises thinner blades (when dry) and yellowish-green spadices with a cobbled appearance due to its thickened and elevated tepals.

**Distribution and ecology.** Endemic to Panama. It represents an extremely rare species, only six collections are known (three of them from Cerro Pirre). In the study area, this species occurs only in the cloud forests, at elevations above 1300 m.

***Anthurium ramonense*** Engl. ex K. Krause (Fig. 4F)

**Material examined.** Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77105* (MO). Ibid., Estación Rancho Frío at N base of Cerro Pirre, ca 9 km S of El Real, along Quebrada Perisenico, in forest; 08°01′N, 077°44′W; 70–270 m; 8 Oct. 1987; *B.E. Hammel 16113* (MO). Serranía de Pirre, on the northwest slope of the mountain range dominated by Cerro Pirre, along Quebrada Perecingo, a tributary to Río Pirre, about 10 air km south of El Real, in subtropical moist to wet forest associated with streamside or near streamside vegetation; 08°03′N, 077°43′W; 300 m; 29 Jan. 1979; *J.L. Reveal 4888* (MO). Parque Nacional Darién, Cerro Pirre, Rancho Frío; 08°01′14″ N, 077°43′41″ W; 143 m; 13 Apr. 2016; *O.O. Ortiz 2555* (MO, PMA).

**Identification.** *Anthurium ramonense* is characterized by having a rosette-epiphytic habit, conglomerate roots, short petioles, black glandular-punctate blades only on the lower surface and long inflorescences. In the study area this species can be confused with *A. salvinii* Hemsl., which differs in having ribbed petioles and cucculate cataphylls.

**Distribution and ecology.** Colombia, Costa Rica, Nicaragua, and Panama. This species of wide distribution is common to observe it in the evergreen and semideciduous forests of Cerro Pirre. Generally, it has an epiphytic habit, but when it falls from the branches of the host trees, can develop an accidental terrestrial habit.

***Anthurium ravenii*** Croat & R.A. Baker (Fig. 4G)

**Material examined.** Parque Nacional Darién, vicinity of Cerro Pirre base camp, along trail near E side of Río Paracida; 08°00′N, 077°48′W; 0–80 m; 1 Jul. 1988; *T.B. Croat 68966* (MO). Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77088* (MO). About 10 miles S of El Real on Río Pirre (House no. 22); 08°01′N, 077°44′W; 10–11 Aug. 1962; *J.A. Duke 5407* (MO, PMA). Estación Rancho Frío at N base of Cerro Pirre, ca 9 km S of El Real, along Quebrada Perisenico, in forest; 08°01′N, 077°44′W; 70–270 m; 8 Oct. 1987; *B.E. Hammel 16105* (MO). Cerro Pirre, Rancho Frío, Cascada arriba; 08°00′58″N, 077°43′24″W; 164 m; 14 Apr. 2016; *O.O. Ortiz 2571* (PMA). Ibid., Rancho Plástico, camino hacia la cima del Cerro; 07°59′49″N, 077°42′45″W; 636 m; 15 Apr. 2016; *O.O. Ortiz 2577* (PMA). Ibid., campamento cerca del segundo mirador; 07°59′49″N, 077°42′43″W; 610 m; 19 Jul. 2016; *O:O. Ortiz 2723* (PMA).

**Identification.** This species is characterized by its short internodes, semi-intact and deciduous cataphylls at most nodes, reddish-brown blades (when dry), inflorescences with reflexed and brittle spathes (usually deciduous after anthesis), green to whitish, cylindrical spadices, and red berries. On Cerro Pirre it can be confused with *Anthurium* sp. 4, but the latter species is less robust with slender stems and have inflorescences with reddish spathes and pink-salmon spadices. Also, *A. ravenii* can be confused with *A. rotundistigmatum* Croat, but it differs in having greenish blades (when dry), purple spadices and flowers with markedly protruding stigmas. These last species are very similar to *A. ravenii* and both occur on Cerro Pirre, but their populations do not share the same distribution along the elevation gradient. The populations of *A. rotundistigmatum* only grow above 1000 m, whereas those of *A. ravenii* are generally below 900 m.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Honduras, Nicaragua, and Panama. *Anthurium ravenii* represents a wide distribution species that usually ocurrs up to 1000 m (Croat 1986b). On Cerro Pirre, it is common in the semideciduous and evergreen forests, up to 900 m.

***Anthurium rotundistigmatum*** Croat (Fig. 4H)

**Material examined.** El Real, Parque Nacional Darién, high camp and ridge of Cerro Pirre; 07°57′42″N, 077°42′14″W; 1302 m; 28 Jul. 2011; *J.L. Clark 12665* (MO, PMA). Middle slopes on W side of Cerro Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68867* (MO). Ibid.; 07°57′N, 77°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68889* (MO). Cerro Pirre, valley between between Pirre and next most southernly peak, sloping hillside; 07°40′N, 077°42′W; 1250–1300 m; 10 July 1977 - 20 July 1977; *J.P. Folsom 4399* (MO). Ibid.; *J.P. Folsom 4400* (MO). Parque Nacional Darién, Serranía de Pirre, Rancho Plástico; 07°59′13″N, 077°42′28″W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2632* (MO, PMA). Ibid., campamento cerca del segundo mirador; 07°59′49″N, 077°42′43″W; 610 m; 17 Jul. 2016; *O.O. Ortiz 2725* (PMA). Ibid., Rancho Plástico; 07°58′57″N, 077°42′30″W; 1128 m; 18 Jul. 2016; *O.O. Ortiz 2730* (PMA).

**Identification.** This species is characterized by its ovate-triangular, greenish blades (when dry); violet-purple spadices and especially by their round and prominent stigmas. On Cerro Pirre, this species is very similar to *A. ravenii* Croat & R.A. Baker (for differences, see the notes on the latter species).

**Distribution and ecology.** Colombia and Panama. In the study area, the populations of this species occur mainly in the transition area between the submontane and montane forest, which is approximately between 1050 and 1100 m. Individuals can also be seen sporadically in the montane forest (>1100 m). Apparently this species has a preference for slightly open areas with exposure to direct light of the sun.

***Anthurium rubrifructum*** Croat (Figs 4I, 5A)

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68864* (MO). Ibid.; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68942* (MO). Cerro Pirre, ridge top near Rancho Plastico; 07°57′N, 077°42′W; 1200 m; 10–20 Jul. 1977; *J.P. Folsom 4287* (MO). Summit of Cerro Pirre, cloud forest; 07°55′21″N, 077°42′57″W; 1000–1400 m; 29 Dec. 1972; *A.H. Gentry 6993* (MO). Slopes of Cerro Pirre; 07°57′N, 077°42′W; 500–1000 m; 30 Dec. 1972; *A.H. Gentry 7148* (MO). Serranía Pirre, 1.5–2.5 mi. S on ridge from intersection with trail down to Rancho Frío, cloud forest; 07°57′N, 077°43′W, 90–1000 m; 11 Jul. 1977; *R.L. Hartman 4481* (MO, PMA). Parque Nacional Darién, Serranía de Pirre, Rancho Plástico; 07°59′13″N, 077°42′28″W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2635* (MO, PMA). Ibid.; 07°58′57″N, 077°42′30″W; 1128 m; 18 Jul. 2016; *O.O. Ortiz 2732* (PMA).

**Identification.** The species is recognized by its nomadic vine life form, D-shaped petioles, brownish blades (when dry), more or less panduriform blades with the posterior lobes longer than wide (which are projected backward), greenish and reflexed spathes, and red berries. Croat (1986), mentioned that the color of the spadix is unknown for this species. During the samplings, it was determined that the species have pale-pinkish spadices and flowers with white and exserted stamens. In the field, *A. rubrifructum* could only be confused with *A. hartmanii* Croat & O. Ortiz (for differences, see notes on this species) and *A. panduriforme* Schott. The latter differs in having yellowish glossy blades (when dry), 15–30 primary lateral veins, and yellow spadices.

**Distribution and ecology.** Endemic species of Panama that is restricted to the montane cloud forest of Cerro Pirre, which is located above 1100 m. It is very abundant, mainly in places with lots of shade and haze. Individuals usually grow as nomadic vine and climb trees up to 10 m without disconnecting from the ground.

***Anthurium salvinii*** Hemsl. (Fig. 5B)

**Material examined.** Parque Nacional Darién, Cerro Pirre. Rancho Frío, Cascada arriba; 08°00′58″N, 077°43′24″W; 164 m; 14 Apr. 2016; *O.O. Ortiz 2565* (PMA). Ibid., orillas del río Perresenico; 08°01′11″N, 077°43′51″W; 110 m; 1 Dec. 2016; *O.O. Ortiz 2697* (PMA). Ibid., campamento cerca del segundo mirador; 07°59′49″N, 077°42′43″W; 610 m; 3 Dec. 2016; *O.O. Ortiz 2720* (PMA).

**Identification.** This species is characterized by having short stems and internodes, intact, persistent and cucculate cataphylls, petioles usually ribbed, pendent inflorescences, and lilac, tapered and slender spadices. In the field, this species can be confused with *A. ramonense* Engl. ex K. Krause and with juvenile individuals of *A. michelii* Guillaumin, but both differs because they lack cucculate cataphylls (see the additional differences in the notes on both species).

**Distribution and ecology.** Colombia, Costa Rica, Guatemala, Honduras, Mexico, Nicaragua, and Panama. *Anthurium salvinii* is a fairly common species on Cerro Pirre. It grows along semideciduous and evergreen forests, from 90 to 800 m. It is usual to observe this species as an epiphyte; however, it can grow as terrestrial or on rocks (epilitic). Its massively conglomerate roots and the arrangement of leaves in rosettes, allow it to accumulate detritus and moisture, as litter-trapping plants (see Zona and Christenhusz 2015). Probably, this mechanism allows the plant to establish itself successfully and grow in dry soils with few nutrients.

***Anthurium scandens*** subsp. ***pusillum*** R. Sheffer (Fig. 5C)

**Material examined.** Parque Nacional Darién, Cerro Pirre, Rancho Plástico; 07°59′43″N, 077°42′39″W; 700 m; 18 Jul. 2016; *J Aranda s.n.* (PMA). Cerro Pirre; 07°52′N, 077°44′W; 4 Aug. 1967; *N. Bristán 1242* (MO). Ibid., cloud forest and/or mossy forest; 07°50′N, 077°44′W;

**Figure 5.** Some aroids from Cerro Pirre. **A.** *Anthurium rubrifructum* (inflorescence). **B.** *Anthurium salvinii* (inflorescence). **C.** *Anthurium scandens* (infructescence). **D.** *Anthurium talamancae* (inflorescence). **E.** *Anthurium terryae* (infructescence). **F.** *Anthurium terryae* (inflorescence). **G.** *Anthurium tonduzii* (inflorescence). **H.** *Anthurium trilobum* (inflorescence). **I.** *Anthurium* sp. 2 (infructescence).

750–1300 m; 9–10 Aug. 1967; *J.A. Duke 13701* (MO). Serranía Pirre, on main ridge from intersection with trail down to Rancho Frío to 1.5 mi. N of that point; 08°00′N, 077°43′W; 800–900 m; 12 Jul. 1977; *R.L. Hartman 4547* (MO, PMA).

**Identification.** This taxon is characterized by having an epiphytic-climbing habit, short stems and internodes, fibrous-persistent cataphylls, black glandular-punctate blades, usually pendent inflorescences, small spathes and spadices (<1.0 cm long) and whitish berries. *Anthurium scandens* subsp. *pusillum* differs from the typical subspecies (*A. scandens* subsp. *scandens*) in having spadices with fewer flowers (<13 flowers per spadix), small leaves, and very small spadices (up to 1.0 cm long). In the study area it could be confused with *A. tonduzii* Engl., but the latter differs in having intact and deciduous cataphylls, markedly ovate blades and reddish spadices.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Honduras, Nicaragua, Panama, and Venezuela. This taxon generally ocurrs in montane and submontane forests, above 600 m (Croat 1986b). On Cerro Pirre, it represents a relatively rare species. Along the elevation gradient, it can only be observed in the montane cloud forest above 1100 m.

***Anthurium talamancae*** Engl. (Fig. 5D)

**Material examined.** Parque Nacional Darién. Serranía de Pirre, Rancho Plástico; 07°59′13″N, 077°42′28″W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2639* (PMA).

**Identification.** This species is characterized by its epiphytic habit, short stems and internodes, intact and deciduous cataphylls in most of the upper nodes, subcordate (sometimes slightly cordate) blades, three to five pairs of basal veins (usually three fused together and two free), 10 to 13 primary lateral veins per side, green reflexed spathes and violet spadices. Previously, it was considered a synonym of *Anthurium cuspidatum* Mast. (Croat 1986; Grayum 2003), but is now currently considered an accepted name (see Croat and Ortiz 2016). *Anthurium talamancae* is similar to the sympatrics *Anthurium* sp. 3 and *A. cerropirrense* Croat, but both differs mainly in having free basal veins and reddish to reddish-purple spadices (for more differences, see the notes on both species).

**Distribution and ecology.** Costa Rica, Colombia, and Panama. This species is relatively rare on Cerro Pirre. Along the elevation gradient it only ocurrs in the montane cloud forest above 1100 m. Generally, it grows as an epiphyte on the lower branches of the host trees (between 3 and 5 m).

***Anthurium terryae*** Standl. & L.O. Williams (Fig. 5E, F)

**Material examined.** Cerro Pirre, Rancho Plástico, Serranía del Pirre, PN Darién, bosque nuboso; 07°59′23″N, 077°42′28″W, 1077 m, 20 Apr. 2016; *J.E. Batista 1574* (PMA). Ibid.; *J.E. Batista 1577* (PMA). Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68946* (MO). Cerro Pirre, cloud forest and/or mossy forest; 07°50′N, 077°44′W; 750–1300 m; 9–10 Aug. 1967; *J.A. Duke 13732* (MO). Ibid.; *J.A. Duke 13824* (MO). Ascent of Cerro Pirre from Río Pirre S of El Real; 07°57′N, 077°43′W; 600–750 m; 11 Aug. 1962; *J.A. Duke 5327* (MO). Cerro Pirre, cloud forest; 07°51′N, 077°44′W; Oct. 1962; *J.A. Duke 6117* (MO). Ibid., ridgetop and slope from Rancho Frío to Rancho Plástico; 08°01′N, 077°42′W; 800–1200 m; 10–20 Jul. 1977; *J.P. Folsom 4201* (MO). Ibid.; *J.P. Folsom 4216* (MO). Cerro Pirre, ridge top near Rancho Plastico; 07°57′N, 077°42′W; 1200 m; 10–20 Jul. 1977; *J.P. Folsom 4278* (MO). Ibid.; *J.P. Folsom 4309* (MO). Ibid., valley in between Pirre and mountain directly south; 07°40′N, 077°42′W; 10–20 Jul. 1977; *J.P. Folsom 4357* (MO). Ibid.; *J.P. Folsom 4357A* (MO). Top of ridge leading to Cerro Pirre, area near Rancho Plastico; 07°51′N, 077°42′W; 1200–1400 m; 13 Nov. 1977; *J.P. Folsom 6273* (MO). Along path on ascending ridge to Cerro Pirre from Pijibasal, nearly vertical ascent from Rancho Frio (600 m) to ridgetop grade running to Rancho Plastico (1100 m); 07°51′N, 077°42′W; 600–1100 m; 30 Jun. 1980; *J.P. Folsom 8546* (MO). Serranía Pirre, trail between Rancho Frío and the top ridge; 08°01′N, 077°43′W; 700 m; 10 Jul. 1977; *R.L. Hartman 4461* (MO, PMA). Ibid., trail ca 1 mi. SSW of Cerro Pirre summit; 07°56′N, 077°42′W; 1200 m; 15 Jul. 1977; *R.L. Hartman 4681* (MO). Ibid.; *R.L. Hartman 4689* (MO). Ibid., N end of range, 2–3 mi. N of Cerro Pirre; 07°56′N, 077°42′W; 1000–1100 m; 30 Dec. 1978; *R.L. Hartman 8507* (MO). Ibid.; *R.L. Hartman 8521* (MO). Ibid.; *R.L. Hartman 8603* (MO). Parque Nacional Darién, caminando entre Campamento Rancho Frío No. 2 hacia la cima de Cerro Pirre; 08°00′N, 077°45′W; 700–1000 m; 7 Feb. 1991; *H. Herrera 855* (MO). Ibid.; *H. Herrera 875* (MO). On ridge of Cerro Pirre; 07°56′N, 077°42′W; 1000–1080 m; 14 Sept. 1989; *G. McPherson 14081* (MO). North slopes of Cerro Pirre, lower montane rain forest (cloud forest); 07°54′N, 077°42′W; 700–950 m; 7 Apr. 1975; *S. Mori 5474* (MO). Parque Nacional Darién, Cerro Pirre; 07°46′00″N, 077°44′06″W; 1600 m; 12 May 1999; *A. Zapata 1548* (MO). Ibid.; 1400 m, *Zapata 1577* (PMA). Ibid., Rancho Plástico; 07°59′13″N, 077°42′28″W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2634* (MO, PMA). Ibid.; 07°58′57″N, 077°42′30″W; 1128 m; 18 Jul. 2016; *O.O. Ortiz 2729* (PMA).

**Identification.** This species is characterized by its epiphytic habit, short stems and internodes, persistent cataphylls such as fibers, short petioles, D-shaped in cross section with markedly triangular margins, black glandular-punctate blades on both surfaces, oblanceolate to elliptical blades, greenish-gray to blackish (when dry), green spathes, green spadices, flowers with whitish exserted stamens at anthesis, and pendent infructescences with white berries (sometimes greenish at the apex). Croat (1986b) mentioned that this species can have

white berries that later turn purple when mature. On the contrary, all the individuals observed in the populations on Cerro Pirre have the ripe berries consistently white and the immature ones have the greenish apex. This species can be confused with the sympatrics *Anthurium pirrense* Croat and *A. crassitepalum* Croat, but both differs in having terete or subterete petioles and flowers with stamens immersed in the tepals at anthesis (never exserted).

**Distribution and ecology.** Endemic to Panama. In the study area it ocurrs only in the montane cloud forest above 1100 m. It usually grows in the lowest branches of the host trees (between 1 and 7 m) and probably represents the most abundant species of Araceae in the montane cloud forest of Cerro Pirre. During the samplings (carried out in the morning and afternoon), many adult individuals with mature berries were observed. However, seed dispersers were not observed. Therefore, possibly some species of mammal consumes the berries during the night. Additional observations are needed to determine the dispersers of this species.

***Anthurium tonduzii*** Engl. (Fig. 5G)

**Material examined.** Cerro Pirre, Rancho Carajo, Serranía del Pirre, PN Darién, bosque nuboso; 07°58′59″N, 077°42′29″W; 1118 m; 21 Apr. 2016; *J.E. Batista 1578* (PMA). Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68921* (MO). Cerro Pirre, ridge top near Rancho Plastico; 07°57′N, 077°42′W; 1200 m; 10–20 Jul. 1977; *J.P. Folsom 4301* (MO). Serranía de Pirre, N end of range, 2–3 mi. N of Cerro Pirre; 07°56′N, 077°42′W; 1000–1100 m; 29 Dec. 1978; *R.L. Hartman 8496* (MO). Ibid., vicinity of Cerro Pirre; 07°52′N, 077°46′W; 1300–1500 m; 2 Jan. 1979; *R.L. Hartman 8547* (MO). Parque Nacional Darién. Serranía de Pirre, Rancho Plástico; 07°59′13″N, 077°42′28″W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2641* (PMA).

**Identification.** This species is characterized by its epiphytic-climbing habit, long stems and internodes, intact and deciduous cataphylls in most of the upper nodes, black glandular-punctate blades, ovate to ovate-elliptic, reddish spadices, and white berries (violet at apex). On Cerro Pirre, this species can be confused with *Anthurium scandens* subsp. *pusillum* Scheffer and *A. obtusum* (Engl.) Grayum, but both differs mainly in having fibrous and persistent cataphylls.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, and Panama. This species ocurrs in the submontane and montane forests of Cerro Pirre, generally in places above 800 m. It is relatively common in shaded or semi-shaded areas.

***Anthurium trilobum*** hort. ex André (Fig. 5H)

**Material examined.** Parque Nacional Darién, vicinity of Cerro Pirre base camp, along trail near E side of Río Paracida; 08°00′N, 077°48′W; 0–80 m; 1 Jul. 1988; *T.B. Croat 68999* (MO). Ibid., along trail from base camp to Rancho Frío on slopes of Cerro Pirre; 07°58′N, 077°43′W; 200–450 m; 27 July 1994; *T.B. Croat 77129* (MO). Ibid., Campamento Rancho Frío No. 2, subiendo hacia Cerro Pirre; 08°00′N, 077°45′W; 600–750 m; 6 Feb. 1991; *H. Herrera 848* (MO). Ibid., trocha limitrofe del parque, vecindad de la Estación Pirre; 08°00′N, 077°45′W; 500–100 m; *H. Herrera 913* (MO, PMA). Summit of Cerro Pirre; 07°52′00″N, 077°42′30″W; 1000 m; 8 Mar. 1972; *A.H. Gentry 4602* (MO). Slopes of Cerro Pirre; 07°57′N, 077°42′W; 500–1000 m; 30 Dec. 1972; *A.H. Gentry 7124* (MO). North slopes of Cerro Pirre, wet forest; 08°00′N, 077°42′W; 300–700 m; 4 Apr. 1975; *S. Mori 5385* (MO). Cerro Pirre, Rancho Frío. Cascada arriba; 08°00′58″ N, 077°43′24″ W; 164 m; 14 Apr. 2016; *O.O. Ortiz 2564* (PMA). Ibid., campamento cerca del segundo mirador; 07°59′43″ N, 077°42′39″ W; 708 m; 1 Dec. 2016; *O.O. Ortiz 2709* (PMA).

**Identification.** *Anthurium trilobum* is characterized by having slightly long stems, persistent cataphylls such as fibers, blades with naked ribs, trilobed with falcate lateral lobes, reflexed and brittle green spathes, and stipitate yellow spadices. *Anthurium trilobum* is the only species on Cerro Pirre that has trilobed blades with falcate lateral lobes, although in some cases, it can be confused with *A. panduriforme* (for the differences, see couplet 11 of the key).

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, and Panama. This species is very common in the semideciduous and evergreen forests of Cerro Pirre and generally ocurrs up to 1000 m, although there are records that this species can ocurrs on the top of the mountain, ca 1400 m (Carlsen and Croat 2007).

***Chlorospatha mirabilis*** (Mast.) Madison

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68888* (MO).

**Identification.** *Chlorospatha mirabilis* is characterized by its terrestrial habit, milky sap, trilobed or trisect leaves, usually maculate, long inflorescences, and spadices with a very long sterile region (approximately one-third of the total). By the combination of characters mentioned, this species has no similar species on Cerro Pirre, although in the field could be confused with *Philodendron tripartitum* (Jacq.) Schott, which differs by having colorless or reddish latex and fused stamens as synandria.

**Distribution and ecology.** Colombia, Ecuador, and Panama. In Panama, the populations of this species are found only in Darién Province. The collection data from the only specimen of Cerro Pirre indicate that it grows in the evergreen forest, between 550 and 760 m. During the samplings it was not possible to observe individuals of this species.

***Dieffenbachia isthmia*** Croat (Fig. 2D)

**Material examined.** Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77115* (MO). Ibid., Rancho Plástico, camino hacia la cima del Cerro; 07°59′49″N, 077°42′45″W; 636 m; 15 Apr. 2016; *O.O. Ortiz 2581* (PMA).

**Identification.** This species is characterized by its relatively small size (usually up to 1 m), as well as by having milky sap, subcordate blades, blackish (when dry), rounded or auriculate petiole sheaths at apex and spadices with a sterile region. In the field, this species can be vegetatively confused with juvenile individuals of *Dieffenbachia longispatha* Engl. & K. Krause, which differs in having brownish-green blades (when dry) and decurrent petiole sheaths at apex.

**Distribution and ecology.** Colombia and Panama. *Dieffenbachia isthmia* represents a common species in the semideciduous and evergreen forests of Cerro Pirre. It usually grows below 800 m, and it is common to find them growing in colonies along rivers and streams.

***Dieffenbachia killipii*** Croat (Fig. 2C)

**Material examined.** Vicinity of base camp on W side of Cerro Pirre; 08°00′N, 077°48′W; 50 m; 30 Jun. 1988; *T.B. Croat 68961* (MO). Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77102* (MO). Parque Nacional del Darién, Estación Rancho Frío at N base of Cerro Pirre, ca 9 km S of El Real, in forest along Quebrada Perisenico, primary forest with *Jessenia bataua*, *Astrocaryum standleyanum*, *Phytelephas* and *Brownea*; 08°01′N, 077°44′W; 70–270 m; 8 Oct. 1987; *G. de Nevers 8267* (MO). Cerro Campamento (south of Cerro Pirre), cloud forest; 07°47′N, 077° 43′W; 20–22 Mar. 1968; *J.A. Duke 15591* (MO). Area around Rancho Frío, 1/2 way up slope of Cerro Pirre from Piji Vasal; 08°01′N, 077°44′W; 12 Nov. 1977; *J.P. Folsom 6247* (MO). Parque Nacional Darién, Cerro Pirre, Rancho Frío; 08°01′16″N, 077°44′04″W; 103 m; 13 Apr. 2016; *O.O. Ortiz 2543* (PMA). Ibid.; 08°01′16″N, 077°44′04″W; 103 m; 13 Apr. 2016; *O.O. Ortiz 2547* (PMA). Ibid., cascada arriba; 08°00′58″N, 077°43′24″W; 164 m; 14 Apr. 2016; *O.O. Ortiz 2572* (PMA). Ibid., orillas del río Perresenico; 08°01′15″N, 077°43′58″W; 112 m; 1 Dec. 2016; *O.O. Ortiz 2693* (PMA). Ibid.; 08°01′15″N, 077°43′58″W; 112 m; 1 Dec. 2016; *O.O. Ortiz 2694* (PMA). Ibid.; 08°01′11″N, 077°43′51″W; 110 m; 1 Dec. 2016; *O.O. Ortiz 2712* (PMA). Ibid., campamento cerca del segundo mirador; 07°59′49″N, 077°42′43″W; 610 m; 3 Dec. 2016; *O.O. Ortiz 2721* (PMA).

**Identification.** This species is characterized by having relatively small size, milky sap, subcordate blades, greenish when dry, auriculate petiole sheaths at apex, and especially by lacking the medial sterile region between the female and male portion of the spadix. *Dieffenbachia killipii* is the only species of the genus on Cerro Pirre that lacks the medial sterile region.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Panama, and Peru. *Dieffenbachia killipii* is particularly abundant in the semideciduous lowland forest of Cerro Pirre. Unlike the remaining *Dieffenbachia* species in the study area, the individuals of *D. killipii* grow more or less dispersed and not as colonies along rivers and streams.

***Dieffenbachia longispatha*** Engl. & K. Krause (Fig. 2E)

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68854* (MO). Parque Nacional Darién, vicinity of Cerro Pirre base camp, along trail near E side of Río Paracida; 08°00′N, 077°48′W; 0–80 m; 1 Jul. 1988; *T.B. Croat 68971* (MO). Ibid., vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat* 77101 (MO). Ibid., Cerro Pirre, campamento cerca del segundo mirador; 07°59′43″N, 077°42′39″W; 708 m; 2 Dec. 2016; *O.O. Ortiz 2704* (PMA).

**Identification.** This species is characterized by its terrestrial and robust plants (usually greater than 1 m) with copious milky sap, a strong foul aroma, greenish blades when dry, decurrent petiole sheaths at apex and spadices with the sterile medial region. Croat (2004) included a specimen (Croat 68854) collected at Cerro Pirre under *D. nitidipetiolata* Croat & Grayum, but it turned out to be *D. longispatha*. *D. nitidipetiolata* differs from *D. longispatha* by having very glossy petioles (similar to a varnished surface) and female portion of spadix with moderately closely spaced pistils

**Distribution and ecology.** Colombia and Panama. It is relatively common on Cerro Pirre. It grows both in the semideciduous and evergreen forests, usually between 150 and 800 m. It usually forms colonies on flat sites near the banks of streams or in semi-shady forested areas.

***Heteropsis oblongifolia*** Kunth (Fig. 2F)

**Material examined.** Parque Nacional Darién, Cerro Pirre, campamento cerca del segundo mirador; 07°59′ 49″N, 077°42′43″W; 610 m; 3 Dec. 2016; *O.O. Ortiz 2718* (MO, PMA).

**Identification.** *Heteropsis oblongifolia* is recognized by its nomadic vine life form, slender and woody stems, distichous leaves, very short petioles without geniculum, simple and subcoriaceous blades, and uniform spadices with bisexual flowers. In the study area, this species does not share morphological similarities with other species of Araceae, although if seen from a distance, it could be confused with some species of *Anthurium* with an escandent-epiphytic habit (for example, *A. obtusum*) or individuals of the family Marcgraviaceae.

**Distribution and ecology.** Bolivia, Brazil, Colombia, Costa Rica, Ecuador, Nicaragua, Panama, and Venezuela. This species represents a rare species on Cerro Pirre. The only existing record was in the evergreen forest near

700 m. Based on the observations made in the field, this species can reach up to 25 m high. According to Grayum (2003), this species usually flowers in the forest canopy.

***Monstera adansonii*** subsp. ***laniata*** (Schott) Mayo & I.M. Andrade

**Material examined.** Río Pirre; 07°55′N, 077°44′W; 14 Jul. 1971; *T.B. Croat 15487* (MO, PMA). On ridge of Cerro Pirre, wet forest; 07°56′N, 077°42′W; 1000–1080 m; 14 Sept. 1989; *G. McPherson 14084* (MO). Parque Nacional Darién, Serranía de Pirre, Rancho Plástico; 07°59′13″ N, 077°42′28″ W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2645* (MO, PMA). Ibid.; 07°59′13″ N, 077°42′28″ W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2646* (PMA).

**Identification.** This taxon is characterized by having D-shaped petioles in cross section, ovate-elliptic blades, usually perforated with entire margins, unequal at the base (one side truncated to subcorded and the other side cuneate to acute), parallel secondary lateral veins, conspicuous and numerous primary lateral veins (10–20 per side), inflorescences with long peduncles (>5.0 cm long), and peduncles that equal or exceed the spadices. On Cerro Pirre, this taxon could be confused with *Monstera oreophila*, which differs in having the unsheathed portion of the petiole U-shaped in cross section and primary lateral veins more than 25 per side.

**Distribution and ecology.** Lesser Antilles, Brazil, Colombia, Costa Rica, Curaçao, Ecuador, El Salvador, Guatemala, Guyana, French Guiana, Honduras, Nicaragua, Panama, Peru, Suriname, and Venezuela. On Cerro Pirre, *Monstera adansonii* subsp. *laniata* is distributed uniformly throughout the elevation gradient, but its abundance is accentuated in the montane cloud forest, which is located at elevations above 1100 m.

***Monstera dubia*** (Kunth) Engl. & K. Krause (Fig. 6B, C)

**Material examined.** Parque Nacional Darién, Cerro Pirre, Rancho Frio, cerca de la estación de la antigua ANAM; 08°01′16″N, 077°44′04″W; 103 m; 17 Apr. 2016; *O.O. Ortiz 2592* (PMA).

**Identification.** *Monstera dubia* is characterized by comprising juvenile plants with variegated leaves tightly appressed to the substrate and adult individuals with verrucose stems, deciduous petiole sheaths, oblong-ovate blades, subcordate at base, reticulate secondary lateral veins and inflorescences with green-pinkish spathes and whitish spadices. It is common to confuse juvenile individuals of this species with those of *M. spruceana* (Schott) Engl., which differs in lacking variegated leaves.

**Distribution and ecology.** Belize, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, Guatemala, Guyana, French Guiana, Honduras, Mexico, Nicaragua, Panama, Peru, and Venezuela. On Cerro Pirre, it is common to observe individuals of this species in the semideciduous lowland forests (100–400 m) and along the rivers and streams, but it is less common within the mid-elevation evergreen forests, between 600 and 800 m.

***Monstera oreophila*** Madison

**Material examined.** Serranía de Pirre, trail ca 1 mi. SSW of Cerro Pirre summit; 07°56′N, 077°42′W; 1200 m; 15 Jul. 1977; *R.L. Hartman 4679* (MO). Ibid., E ridge, ca 1.5 mi. N of Cerro Pirre; 07°56′N, 077°42′W; 1100–1200 m; 9 Jan. 1979; *R.L. Hartman 8610* (MO).

**Identification.** This species is characterized by having U-shaped petioles in cross section; ovate, lanceolate-ovate, oblong or oblong-elliptic blades, usually perforated with entire margins, truncate, rounded or cuneate at base, parallel secondary lateral veins, conspicuous and numerous primary lateral veins (>25 per side), and inflorescences with pinkish spathes. Grayum (2003) mentioned that *Monstera oreophila* is the only species of the genus that presents blades with parallel secondary lateral veins and pinkish spathes. The populations of this species are found mainly in Costa Rica and western Panama (Chiriquí and Coclé Provinces). The presence of this species on Cerro Pirre can be somewhat uncertain, as a result of which its populations have not been adequately documented. The specimens examined from Cerro Pirre have been tentatively included in this species, because they share similar vegetative characteristics. However, to confirm the taxonomic identity, it is necessary to make more collections and verify the color of the spathe at anthesis.

**Distribution and ecology.** Costa Rica and Panama**.** The information provided on the labels of the specimens indicates that it ocurrs in montane cloud forests of Cerro Pirre, usually above 1100 m.

***Monstera pinnatipartita*** Schott

**Material examined.** About 10 mi. S of El Real on Río Pirre (House no. 22); 08°01′N, 077°44′W; 10–11 Aug. 1962; *J.A. Duke 5461* (MO, PMA). Parque Nacional Darién, Cerro Pirre, Rancho Frío; 08°01′16″ N, 077°44′04″ W; 103 m; 13 Apr. 2016; *O.O. Ortiz 2553* (PMA).

**Identification.** This species is characterized by having deciduous petiole sheaths, pinnatilobed or pinnatifid blades with narrow segments (1–3 cm wide). In the study area it can be confused with *M. spruceana*, which differs in comprising juvenile plants with leaves tightly appressed to the substrate, persistent petiolar sheaths and blades with broad segments (5–14 cm wide).

**Distribution and ecology.** Bolivia, Colombia, Costa Rica, Ecuador, El Salvador, Panama, and Venezuela. *Monstera pinnatipartita* is a very common species on Cerro Pirre, both in semideciduous and evergreen forests. It is common to observe many juvenile individuals of this species on understory and few adult individuals along the forest.

***Monstera pittieri*** Engl.

**Material examined.** Vicinity Cerro Pirre, along trail from base camp to Rancho Frío on slopes of Cerro Pirre; 07°58′N, 077°43′W; 200–450 m; 27 Jul. 1994; *T.B. Croat 77130* (MO). Parque Nacional Darién, trocha entre la Estación Pirre y el Cerro Pirre; 08°00′N, 077°45′W; 100–300 m; 11 Feb. 1991; *H. Herrera 933* (MO, PMA). Ibid., Cerro Pirre, Rancho Frío; 08°01′14″N, 077°43′41″W; 143 m; 13 Apr. 2016; *O.O. Ortiz 2559* (PMA). Ibid., cascada arriba; 08°00′58″N, 077°43′24″W; 164 m; 14 Apr. 2016; *O.O. Ortiz 2570* (PMA).

**Identification.** *Monstera pittieri* comprises nomadic vines with long internodes, small blades, sometimes perforated, entire margins; inconspicuous primary lateral veins, and short peduncles. On Cerro Pirre, *M. pittieri* is the only species of the genus that comprises adult plants with usually entire blades with inconspicuous primary lateral veins and short peduncles (up to 4 cm long). This species could be confused with juvenile individuals of *M. spruceana* (Schott) Engl., which differs by its appressed habit and juvenile plants with leaves tightly appressed to the substrate.

**Distribution and ecology.** Colombia, Costa Rica, and Panama. This species grows in semideciduous and evergreen forests of Cerro Pirre. It represents an uncommon species, usually found in semi-shaded areas.

***Monstera spruceana*** (Schott) Engl. (Fig. 6A)

**Material examined.** Parque Nacional Darién, Cerro Pirre, Rancho Frío; 08°01′16″N, 077°44′04″W; 103 m; 13 Apr. 2016; *O.O. Ortiz 2550* (MO, PMA).

**Identification.** This species is characterized by having juvenile plants with non-variegated leaves tightly appressed to the substrate and adult individuals with persistent petiole sheaths, pinnatilobed or pinnatifid blades blades with broad segments (5–14 cm wide). During the juvenile stages, *M. spruceana* can be confused with *M. dubia* (Kunth) Engl. & K. Krause, which differs in having variegated leaves with whitish spots above. When adults, *M. spruceana* can be confused with *M. pinnatipartita* Schott. However, they are easily differentiated by vegetative characters (see couplet 55 of the key).

**Distribution and ecology.** Bolivia, Brazil, Colombia, Costa Rica, Ecuador, French Guiana, Panama, Peru, Suriname, and Venezuela. *Monstera spruceana* is a highly common species on Cerro Pirre, both in semideciduous and evergreen forests. It can grow in open areas along trails, in gallery forests and in shady forested areas.

***Philodendron albisuccus*** Croat (Fig. 7B)

**Material examined.** Serranía de Pirre, along steep narrow ridge from Alturas de Nique to Cerro Pirre, ca 9–10 km due N of Alturas de Nique, ca 8 km W of Cana gold mine, virgin cloud forest, lower montane rain forest (Holdrige Life Zone System); 07°44′N, 077°43′W; 1430–1480 m; 27 Jul. 1976; *T.B. Croat 37851* (MO). Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68940* (MO, PMA). Parque Nacional Darién, Serranía de Pirre, Rancho Plástico; 07°59′13″ N, 077°42′28″ W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2633* (MO, PMA). Ibid.; 07°58′54″ N, 077°42′30″ W; 1128 m; 31 Jul. 2016; *O.O. Ortiz 2658* (PMA).

**Identification.** This species is characterized by its short internodes, fibrous persistent cataphylls, subterete petioles (almost as long as the blade), and narrowly ovate blades, which are moderately cordate at base with a hippocrepiform sinus and naked posterior ribs. *Philodendron albisuccus* is the only species of Cerro Pirre that has whitish sap when cutting its vegetative parts.

**Distribution and ecology.** Colombia and Panama. On Cerro Pirre, *P. albisuccus* ocurrs only in submontane and montane forests, generally above 800 m. This species grows frequently on trunks and branches located between 2 to 5 m high.

***Philodendron alliodorum*** Croat & Grayum

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68868A* (MO). Vicinity Cerro Pirre, 17 km S of El Real, along trail from base camp, along Río Perisenico; 08°01′N, 077°44′W; 100 m; 28 Jul. 1994; *T.B. Croat 77175* (MO). South of El Real along trail at base of Cerro Pirre, forest; 08°00′N, 077°45′W; 50 m; 31 Mar. 1985; *G. McPherson 7079* (MO). Parque Nacional Darién, Cerro Pirre, Rancho Frío; 08°01′16″N, 077°44′04″W; 103 m; 13 Apr. 2016; *O.O. Ortiz 2536* (PMA). Ibid.; *O.O. Ortiz 2538* (PMA). Ibid., Rancho Plástico, camino hacia la cima del Cerro; 07°59′49″N, 077°42′45″W; 636 m; 15 Apr. 2016; *O.O. Ortiz 2585* (PMA).

**Identification.** This species is characterized by its nomadic vine life form, relatively short petioles (less than half the length of the blades) with involute sheaths, which extend to near the base of the blade and by its reddish-brown narrow blades (when dry), with numerous primary lateral veins (10–14 pairs). In the field, it is very difficult to differentiate from *P. inaequilaterum* Liebm., which differs in having rigidly scandent habit (usually appressed to host trees), broader blades, strongly unequal at base, blackish (when dry), inflorescences usually solitary and orange berries.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Nicaragua, and Panama. This species is common throughout the semideciduous lowland forests of Cerro Pirre and less common in the mid-elevation evergreen forests (between 600 and 800 m). Individuals of *P. alliodorum* usually grow in large numbers on the same tree together with those of *P. inaequilaterum* Liebm. and *Monstera spruceana* (Schott) Engl.

***Philodendron clewellii*** Croat

**Figure 6.** Some aroids from Cerro Pirre. **A.** *Monstera spruceana* (infructescence). **B.** *Monstera dubia*. **C.** *Monstera dubia* (inflorescence). **D.** *Syngonium podophyllum* (inflorescence). **E.** *Syngonium hoffmannii* (inflorescence). **F.** *Rhodospatha moritziana*. **G.** *Rhodospatha wendlandii*.

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68945* (MO). Ibid.; *T.B. Croat 68957* (MO). Parque Nacional Darién, Serranía de Pirre, Rancho Plástico; 07°59′13″N, 077°42′28″W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2643* (PMA).

**Identification.** This species is distinguished by its nomadic vine life form, very long stems (10 m long), long internodes, deciduous cataphylls, subterete petioles, ovate blades, cordate at base, dark brown when dry, usually free basal veins, naked posterior ribs (when present), narrow and closed sinus, inflorescences arranged in groups of up to six per node and by its purple spathe tubes externally and creamy-white spathe blades on both

**Figure 7.** Some aroids from Cerro Pirre. **A.** *Rhodospatha wendlandii* (inflorescence). **B.** *Philodendron albisuccus* (infructescence). **C.** *Philodendron tuerckheimii* (inflorescence). **D.** *Philodendron ligulatum* var. *heraclioanum* (inflorescence). **E.** *Philodendron opacum* (infructescence). **F.** *Philodendron tenue* (infructescence).

surfaces. There are no similar species to *P. clewellii* on Cerro Pirre.

**Distribution and ecology.** Endemic to Panama. *Philodendron clewellii* represents an extremely rare species and is only known from the montane cloud forests of Cerro Pirre, located above 1100 m.

***Philodendron edenudatum*** Croat (Fig. 8A)

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68891* (MO). Ibid.; *T.B. Croat 68901* (MO). Ibid.; *T.B. Croat 68903* (MO). Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77087* (MO). Vicinity Cerro Pirre, 17 km S of El Real, along trail from base camp, along Río Perisenico; 08°01′N, 077°44′W; 100 m; 28 Jul. 1994; *T.B. Croat 77185* (MO). Parque Nacional Darién, Cerro Pirre, Rancho Plástico, camino hacia la cima del Cerro; 07°59′49″N, 077°42′45″W; 636 m; 15 Apr. 2016; *O.O. Ortiz 2584* (PMA). Ibid.; *O.O. Ortiz 2589* (PMA). Ibid., orillas del río Perresenico; 08°01′11″N, 077°43′51″W;

110 m; 1 Dec. 2016; *O.O. Ortiz 2698* (PMA). Ibid.; *O.O. Ortiz 2708* (PMA).

**Identification.** This species is characterized by having slightly elongated internodes, two-ribbed, persistent intact cataphylls, usually mottled purple D-shaped petioles in cross section, ovate blades (often with purple spots on lower surface) with non-naked posterior ribs; solitary inflorescences with red-purple spathe tubes on both surfaces. *Philodendron edenudatum* is very similar to the sympatric *P. sagittifolium* Liebm., which differs in having terete or subterete petioles and deciduous cataphylls in most upper nodes.

**Distribution and ecology.** This endemic species is only known from Veraguas (Santa Fe) and Darién (Pirre). In the study area, *Philodendron edenudatum* is relatively common in semideciduous and evergreen forests, at sites between 90 to 800 m. Generally, it grows as apressed-climbing plants to the host trees.

***Philodendron ensifolium*** Croat & Grayum subsp. ***ensifolium***

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68922* (MO). Cerro Pirre, cloud forest and/or mossy forest; 07°50′N, 077°44′W; 750–1300 m; 9–10 Aug. 1967; *J.A. Duke E13738* (MO).

**Identification.** This taxon is recognized by its nomadic vine life form (appressed-climbing habit), fully sheathed petioles, very narrow glossy blades (more than four times longer than wide), non-cordate at base, with obscure primary lateral veins. *Philodendron ensifolium* subsp. *ensifolium* is the only taxon of the subgenus *Pteromischum* on Cerro Pirre that has finely striate, greenish stems when dry.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, and Panama. This species has only been reported in the submontane forest of Cerro Pirre, between 800 and 1050 m.

***Philodendron fragrantissimum*** (Hook.) G. Don

**Material examined.** Vicinity Cerro Pirre, along trail from base camp to Rancho Frío on slopes of Cerro Pirre; 07°58′N, 077°43′W; 200–450 m; 27 Jul. 1994; *T.B. Croat 77120* (MO, PMA). Parque Nacional Darién, Cerro Pirre, Rancho Frío; 08°01′14″N, 077°43′41″W; 143 m; 13 Apr. 2016; *O.O. Ortiz 2561* (PMA).

**Identification.** This species is distinguished by having short internodes, persistent fibrous brown cataphylls, D-shaped petioles in cross section with erect margins, ovate to triangular-ovate blades with a rounded base and inflorescences with spathe tubes bright-red and spathe blades whitish. On Cerro Pirre, juvenile individuals of this species could be confused with those of *P. platypetiolatum* Madison, which differs mainly in having long internodes and dorsiventrally flattened petioles.

**Distribution and ecology.** Belize, Brazil, Cuba, Colombia, Costa Rica, Ecuador, Guatemala, Guyana, French Guiana, Honduras, Nicaragua, Panama, Peru, Suriname, and Venezuela. This species of wide distribution is common both in the semideciduous and evergreen forests of Cerro Pirre. Individuals of *Philodendron fragrantissimum* usually grow in the lower parts of the host trees, between 1 and 5 m. They frequently form large colonies in the same host tree, reaching up to 15 plants simultaneously in the same phorophyte.

***Philodendron grandipes*** K. Krause

**Material examined.** Vicinity Cerro Pirre, 17 km S of El Real, along trail from base camp, along Río Perisenico; 08°01′N, 077°44′W; 100 m; 28 Jul. 1994; *T.B. Croat 77177* (MO). Parque Nacional Darién, Serranía de Pirre, campamento Rancho Frío, cercano a la loma ensucia pecho; 07°59′49″N, 077°42′45″W; 636 m; 2 Aug. 2016; *O.O. Ortiz 2666* (PMA).

**Identification.** This species is characterized by having terrestrial habit, short internodes, fibrous persistent cataphylls, D-shaped petioles in cross section, broadly ovate blades, cordate at base, and inflorescences with green spathes. On Cerro Pirre, *Philodendron grandipes* is the only species of the genus that consistently have terrestrial habit. Due to the terrestrial habit and the ovate blades, it can be confused with individuals of the genus *Adelonema*, which differs substantially in having armed petioles and diminutive puberulent blades.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Nicaragua, and Panama. *Philodendron grandipes* ocurrs along the deciduous and evergreen forests of Cerro Pirre, between 100 and 800 m. It usually grows near banks and streams, in shady areas.

***Philodendron ichthyoderma*** Croat & Grayum

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68868* (MO). Vicinity Cerro Pirre, 17 km S of El Real, along trail from base camp, along Río Perisenico; 08°01′N, 077°44′W; 100 m; 28 Jul. 1994; *T.B. Croat 77181* (MO). Near airstrip at Cana, base of Cerro Pirre; 07°45′N, 077°41′W; 500 m; 22 Sept. 1982; *C. Hamilton 1450* (MO). North slopes of Cerro Pirre, lower montane rain forest (cloud forest); 07°54′N, 077°42′W; 700–950 m; 7 Apr 1975; *S. Mori 5497* (MO). Parque Nacional Darién, Cerro Pirre, Rancho Frío, cascada arriba; 08°00′58″N, 077°43′24″W; 164 m; 14 Apr. 2016; *O.O. Ortiz 2568* (PMA). Ibid.; *O.O. Ortiz 2735* (PMA).

**Identification.** *Philodendron ichthyoderma* is recognized by its thick and scaly stems, large blades, strongly inequilateral at the base, and numerous primary lateral veins (15 or more per side). In the field, this species can be confused with *P. inaequilaterum* Liemb., which differs in lacking scaly internodes and petioles.

**Distribution and ecology.** Colombia, Ecuador, and Panama. In the study area, *P. ichthyoderma* occurrs usually in semideciduous and evergreen forests, between 50 and 800 m.

***Philodendron immixtum*** Croat

**Material examined.** Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77093* (MO). Ibid., 17 km S of El Real, along trail from base camp, along Río Perisenico; 08°01′N, 077°44′W; 100 m; 28 Jul. 1994; *T.B. Croat 77162* (MO).

**Identification.** This species is characterized by its nomadic vine life form, long and slender internodes, slightly flattened petioles, greenish blades (when dry), narrowly ovate to ovate-elliptic, cordulate at base and solitary inflorescences with reddish spathe tubes internally and white spathe blades on both surfaces. Individuals of this species can be confused with those of *P. ligulatum* var. *heraclioanum* Croat, which differs in having typically larger blades, shorter internodes, erect-undulate petiole margins and blades purple spoted on the lower surface.

**Distribution and ecology.** Colombia and Panama. In the study area, *P. immixtum* has been reported in semideciduous lowland forests at 100 m of elevation. During the samplings, individuals of this species could not be observed.

***Philodendron inaequilaterum*** Liebm.

**Material examined.** Parque Nacional Darién, vicinity of Cerro Pirre base camp, along trail near E side of Río Paracida; 08°00′N, 077°48′W; 0–80 m; 1 Jul. 1988; *T.B. Croat 68967* (MO). Parque Nacional Darién, Cerro Pirre, Rancho Frío; 08°01′16″N, 077°44′04″W; 103 m; 13 Apr. 2016; *O.O. Ortiz 2537* (PMA). Ibid.; *O.O. Ortiz 2539* (PMA). Ibid.; *O.O. Ortiz 2551* (PMA). Ibid.; *O.O. Ortiz 2552* (PMA).

**Identification.** This species is recognized by its nomadic vine life form (appressed-climbing habit), chartaceous blades with numerous primary lateral veins, inequilateral at base, paired inflorescences with slender spadices and orange berries. Grayum (2003) mentioned that this species is very similar to *P. rayanum* Croat & Grayum (also present on Cerro Pirre), but the latter differs in having narrower blades and thicker spadices with a longer female portion.

**Distribution and ecology.** Belize, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru, and Venezuela. *Philodendron inaequilaterum* ocurrs in the semideciduous and evergreen forests of Cerro Pirre, between 90 and 800 m. This species is probably the most abundant of the semideciduous lowland forests of Cerro Pirre. Its spatial distribution appears to be irregular, usually growing in large colonies, both in wooded areas and on open trails and along the banks of rivers and streams.

***Philodendron lazorii*** Croat

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68953* (MO). Vicinity Cerro Pirre, along trail from base camp to Rancho Frío on slopes of Cerro Pirre; 07°58′N, 077°43′W; 200–450 m; 27 Jul. 1994; *T.B. Croat 77126* (MO). Serranía de Pirre, trail ca 1 mi. SSW of Cerro Pirre summit; 07°56′N, 077°42′W; 1200 m; 15 Jul. 1977; *R.L. Hartman 4660* (MO).

**Identification.** This species is distinguished by having thick and short internodes, persistent and semi-intact cataphylls, terete petioles (1.25 times longer than the blade), and broadly ovate blades, greenish-gray when dry. *Philodendron lazorii* is similar to the *sympatric P. panamense* K. Krause, which differs in having glossy ovate-triangular blades, petioles usually shorter than the blade and shorter peduncles (usually shorter than spathe).

**Distribution and ecology.** Colombia and Panama. According to the information of the collections, this species is distributed throughout the Cerro Pirre elevation gradient, in semideciduous, evergreen, and montane forests.

***Philodendron ligulatum*** var. ***heraclioanum*** Croat (Fig. 7D).

**Material examined.** Vicinity of base camp on W side of Cerro Pirre; 08°00′N, 077°48′W; 50 m; 30 Jun. 1988; *T.B. Croat 68963* (MO). Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77098* (MO). Parque Nacional del Darién, Estación Rancho Frio, N base of Cerro Pirre, ca 9 km S of El Real, in forest along Quebrada Perisenico; 08°01′N, 077°44′W; 70–270 m; 8 Oct. 1987; *B.E. Hammel 16145* (MO). Ibid., Pirre, Rancho Frío, orillas del río Perresenico; 08°01′11″N, 077°43′51″W; 110 m; 1 Dec. 2016; *O.O. Ortiz 2695* (PMA). Ibid., campamento cerca del segundo mirador; 07°59′49″N, 077°42′43″W; 610 m; 3 Dec. 2016; *O.O. Ortiz 2719* (PMA).

**Identification.** This taxon is characterized by having intact and deciduous two-ribbed cataphylls, and D-shaped petioles in cross section with oblanceolate-elliptic blades, variegated with purple spots on the lower surfaces (when fresh), blackish when dry. *Philodendron ligulatum* var. *heraclioanum* differs from the other existing varieties (*P. ligulatum* Engl. var. *ligulatum* and *P. ligulatum* var. *ovatum* Croat) by having variegated blades with purple spots on the lower surface and petioles with erect-undulate margins. On Cerro Pirre, *P. ligulatum* var. *heraclioanum* can be confused with *P. pseudoauriculatum* Croat, which differs in having terete to subteretes petioles, lacking erect-undulate margins.

**Distribution and ecology.** Colombia and Panama. In the study area, *Philodendron ligulatum* var. *heraclioanum*

has been reported in semideciduous and evergreen forests, between 50 and 800 m.

***Philodendron niqueanum*** Croat (Fig. 8B)

**Material examined.** Serranía de Pirre, along steep narrow ridge from Alturas de Nique to Cerro Pirre, ca 9 km from Alturas de Nique, ca 8 km W of Cana gold mine, virgin cloud forest, lower montane rain forest (Holdrige Life Zone System); 07°49′N, 077°43′W; 1480–1520 m; 27 Jul. 1976; *T.B. Croat 37886* (MO). Parque Nacional Darién, Serranía de Pirre, Rancho Plástico; 07°59′13″N, 077°42′28″W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2649* (PMA). Ibid.; 07°58′54″N, 077°42′30″W; 1128 m; 31 Jul. 2016; *O.O. Ortiz 2652* (PMA).

**Identification.** This species is characterized by having thick and short internodes; persistent and intact cataphylls, terete petioles, and blades almost as long as the petioles, which are narrowly ovate, dark brown when dry, and cordulate to subcordate at base with V-shaped sinus. Due to its morphological characteristics, this species can not be confused with any other species of Cerro Pirre.

**Distribution and ecology.** Endemic to Panama. On Cerro Pirre, this species only ocurrs in montane cloud forests above 1100 m. It represents a rare species, because fewer than 25 individuals of this species could be observed during the samplings.

***Philodendron opacum*** Croat & Grayum (Fig. 7E)

**Material examined.** Parque Nacional Darién, vicinity of Cerro Pirre base camp, along trail near E side of Río Paracida; 08°00′N, 077°48′W; 0–80 m; 1 Jul. 1988; *T.B. Croat 68978* (MO). Ibid.; *T.B. Croat 68988* (MO). Vicinity Cerro Pirre, along trail from base camp to Rancho Frío on slopes of Cerro Pirre; 07°58′N, 077°43′W; 200–450 m; 27 Jul. 1994; *T.B. Croat 77131* (MO). Ibid., 17 km S of El Real, along trail from base camp, along Río Perisenico; 08°01′N, 077°44′W; 100 m; 28 Jul. 1994; *T.B. Croat 77180* (MO). Parque Nacional del Darién, Estación Rancho Frío at N base of Cerro Pirre, ca 9 km S of El Real, along Quebrada Perisenico, in forest; 08°01′N, 077°44′W; 70–270 m; 8 Oct. 1987; *B.E. Hammel 16157* (MO). Ibid., trocha limitrofe al NO en la vecindad de la Estación Pirre; 08°00′N, 077°45′W; 150 m; 7 Oct. 1990; *H. Herrera 692* (MO, PMA). Ibid., en la trocha limitrofe entre el camino a Cerro Pirre y Balsas; 08°00′N, 077°45′W; 60–150 m; 12 Feb. 1991; *H. Herrera 951* (MO). Ibid., Cerro Pirre, Rancho Frío; 08°01′16″N, 077°44′04″W; 103 m; 13 Apr. 2016; *O.O. Ortiz 2545* (PMA). Ibid., orillas del río Perresenico; 08°01′11″N, 077°43′51″W; 110 m; 1 Dec. 2016; *O.O. Ortiz 2700* (PMA). Ibid.; *O.O. Ortiz 2706* (PMA).

**Identification.** This species is characterized by its nomadic vine life form (appressed-climbing habit), thickly sulcate and yellowish stems (when dry), erect petiole sheaths, non-cordate blades, usually matte or velvety above, uniformly greenish spathes, and straight to slightly curved seeds. On Cerro Pirre, the only species with which it could be confused is *Philodendon sulcatum* K. Krause, because both species have thick sulcate and yellowish stems (when dry). The latter species differs from *P. opacum* in having unsheathed portion of the petioles generally <1 cm long, widely open horizontally winged petiole sheaths and semicochleate to cochleate seeds.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Nicaragua, and Panama. On Cerro Pirre, *P. opacum* represents a common species and grows along semideciduous and evergreen forests, between 60 and 700 m.

***Philodendron panamense*** K. Krause

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68951* (MO). Parque Nacional Darién, vicinity of Cerro Pirre base camp, along trail near E side of Río Paracida; 08°00′N, 077°48′W; 0–80 m; 1 Jul. 1988; *T.B. Croat 68991* (MO). Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77100* (MO). Parque Nacional del Darién, Estación Rancho Frío at N base of Cerro Pirre, ca 9 km S of El Real, along Quebrada Perisenico, in forest; 08°01′N, 077°44′W; 70–270 m; 8 Oct. 1987; *B. Hammel 16131* (MO). Ibid., Cerro Pirre, Rancho Frío; 08°01′16″N, 077°44′04″W; 103 m; 13 Apr. 2016; *O.O. Ortiz 2546* (PMA). Ibid., campamento cerca del segundo mirador; 07°59′49″N, 077°42′43″W; 610 m; 2 Dec. 2016; *O.O. Ortiz 2714* (PMA). Ibid.; *O.O. Ortiz 2722* (PMA). Ibid., Rancho Frío; 08°01′14″N, 077°43′41″W; 143 m; 13 Apr. 2016; *O.O. Ortiz 2816* (PMA).

**Identification.** This species is characterized by its nomadic vine life form (appressed-climbing habit), short internodes, persistent intact or semi-intact cataphylls, terete and striated petioles, broadly ovate blades with parabolic to hypocrepiform sinus, and inflorescences with slightly curved peduncles with greenish spathe tubes externally, greenish spathe blades internally and whitish externally. In the study area, *P. panamense* can be confused with *P. lazorii* Croat due to the similarity in its cataphylls and the blade shape (see the notes for *P. lazorii*).

**Distribution and ecology.** Colombia and Panama. *Philodendron panamense* is common throughout the semideciduous and evergreen forests of Cerro Pirre, between 90 and 800 m.

***Philodendron pirrense*** Croat (Fig. 8C)

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68952* (MO). Parque Nacional Darién, Serranía de Pirre, Rancho Plástico; 07°59′13″N, 077°42′28″W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2636* (MO, PMA).

**Identification.** This species is distinguished by having

**Figure 8.** Some aroids from Cerro Pirre. **A.** *Philodendron edenudatum* (inflorescence). **B.** *Philodendron niqueanum*. **C.** *Philodendron pirrense* (inflorescence). **D.** *Stenospermation angustifolium* (inflorescence). **E.** *Stenospermation* sp. 1 (inflorescence). **F.** *Stenospermation ellipticum* (infructescence).

short internodes, persistent and fibrous reddish cataphylls, slightly flattened petioles adaxially, reddish when dry, broadly ovate and cordate with well-developed posterior ribs, seven to 11 pairs of basal veins, inflorescences up to four per node, whitish peduncles, and spathe tubes reddish externally. On Cerro Pirre, this species can be confused with *Philodendron fragrantissimum* (Hook.) G. Don, but the latter species generally ocurrs in areas below 800 m and differs in having smaller blades with fewer pairs of basal veins (usually four per side).

**Distribution and ecology.** Endemic to Panama. *Philodendron pirrense* represents an extremely rare species. On Cerro Pirre, ocurrs in premontane and montane forests, above 1000 m.

***Philodendron platypetiolatum*** Madison

**Material examined.** Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77116* (MO).

**Identification.** This species is characterized by its nomadic vine life form, slender and elongate internodes, dorsiventral flattened petioles adaxially, ovate-triangular

to ovate, slightly cordate at base and inflorescences with reddish spathe tubes internally. In the study area, this species can be confused with juvenile individuals of *P. fragrantissimum* (Hook.) G. Don (for the differences, see notes for *P. fragrantissimum*).

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Nicaragua, and Panama. This species of wide distribution, is only known from a unique collection on Cerro Pirre. According to the collection information, *P. platypetiolatum* ocurrs in semideciduous forests of Cerro Pirre at ca 100 m.

***Philodendron pseudauriculatum*** Croat

**Material examined.** Vicinity of base camp on W side of Cerro Pirre; 08°00′N, 077°48′W; 50 m; 30 Jun. 1988; *T.B. Croat 68962* (MO). Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77094* (MO). Ibid., Rancho Frío; 08°01′14″N, 077°43′41″W; 143 m; 13 Apr. 2016; *O.O. Ortiz 2560* (PMA).

**Identification.** This species is recognized by its nomadic vine life form (sometimes terrestrial as rosettes), short internodes, subteretes spongy petioles, oblong-elliptic to oblanceolate-elliptic blades, greenish-gray when dry, rounded at the base, inflorescences two to three per node and white to pinkish spathes. Due to the blade shape, *P. pseudauriculatum* can be confused with *P. ligulatum* var. *heraclioanum* Croat, which differs in having D-shaped petioles in cross section with erect-undulate margins and blackish (when dry) and typically purple-spoted blades (when fresh).

**Distribution and ecology.** Colombia and Panama. This species typically has a nomadic vine life form, but occasionally it may have a terrestrial life form as rosettes, mainly in sites with rocky and dry soils. In the study site, *Philodendron pseudauriculatum* generally grows in the semideciduous lowland forests, between 50 and 110 m.

***Philodendron purpureoviride*** Engl.

**Material examined.** Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77117* (MO). Ibid., Rancho Frío, orillas del río Perresenico; 08°01′11″N, 077°43′51″W; 110 m; 13 Apr. 2016; *O.O. Ortiz 2707* (PMA).

**Identification.** This species is recognized by its nomadic vine life form, yellowish and conspicuously exfoliating (often cracked) stem epidermis (when dry), slightly flattened petioles, narrowly ovate and cordate blades that dry greenish yellow, two to three pairs of basal veins, solitary inflorescences with violet-purple spathe tubes on both surfaces. In the study area, this species is similar to *P. platypetiolatum* Madison, which differs in having dorsiventral flattened petioles and blades with more pairs of basal veins (seven to 10 basal veins per side).

**Distribution and ecology.** Colombia, Costa Rica, Ecuador and Panama. In the study area, this species has only been reported in semideciduous lowland forests, near 100 m. It is very common in semi-open areas along rivers and streams.

***Philodendron rayanum*** Croat & Grayum

**Material examined.** Vicinity Cerro Pirre, 17 km N of El Real, along trail from base camp, along Río Perisenico; 08°01′N, 077°44′W; 100 m; 28 Jul. 1994; *T.B. Croat 77175A* (MO). Parque Nacional Darién, Serranía de Pirre, Rancho Plástico; 07°59′13″N, 077°42′28″W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2650* (PMA). Ibid.; 07°58′54″N, 077°42′30″W; 1128 m; 31 Jul. 2016; *O.O. Ortiz 2659* (PMA).

**Identification.** This species is characterized by its nomadic vine life form (rigidly-scandent habit), petioles almost completely sheathed, non-cordate narrow blades with numerous primary lateral veins (nine to 16 per side). In the study area, this species is very similar to *P. inaequilaterum* Liebm. due to the blade shape (see distinctive aspects in the notes for the latter species).

**Distribution and ecology.** Colombia, Costa Rica, and Panama. On Cerro Pirre, this species has been reported in semideciduous lowland and montane cloud forests.

***Philodendron sagittifolium*** Liebm.

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68893* (MO). Ibid.; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68958* (MO).

**Identification.** *Philodendron sagittifolium* is a very variable species (Croat 1997). This species is distinguished mainly by having robust stems, short internodes, intact and deciduous cataphylls, rigid petioles with purple spots, coriaceous ovate-triangular blades, non-naked posterior ribs, inflorescences with green spathes externally (frequently with purple spots on spathe tube), and internally reddish spathe tubes. On Cerro Pirre, this species is similar to *P. edenudatum* Croat, due to the blade shape (see distinctive aspects in the notes for *P. edenudatum*).

**Distribution and ecology.** Belize, Colombia, Costa Rica, Guatemala, Honduras, Mexico, Nicaragua, Panama, and Venezuela. According to the collection information, *P. sagittifolium* ocurrs in evergreen and submontane forests of Cerro Pirre, between 550 and 1050 m.

***Philodendron sulcatum*** K. Krause

**Material examined.** Parque Nacional Darién, vicinity of Cerro Pirre base camp, along trail near E side of Río Paracida; 08°00′N, 077°48′W; 0–80 m; 1 Jul. 1988; *T.B. Croat 68990* (MO).

**Identification.** *Philodendron sulcatum* is distinguished by having yellowish and markedly sulcate stems (when

dry), horizontally splayed petiole sheaths, small blades, and alveolate or subalveolate upper leaf epidermis. On Cerro Pirre, *P. sulcatum* could be confused with *P. opacum* Croat & Grayum, but the latter differs in having erect petiole sheaths and longer unsheathed portion of petioles (>1 cm long) (see couplet 78 of the key).

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Nicaragua, and Panama. In the study area, this species has only been recorded in the semideciduous lowland forest. According to Grayum (2003), individuals of this species are frequently found in slightly disturbed sites such as abandoned plantations, secondary forests, or along forest trails.

***Philodendron tenue*** K. Koch & Augustin (Fig. 7F)

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68871* (MO). Ibid.; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68954* (MO). Parque Nacional Darién, vicinity of Cerro Pirre base camp, along trail near E side of Río Paracida; 08°00′N, 077°48′W; 0–80 m; 1 Jul. 1988; *T.B. Croat 68998* (MO). Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77107* (MO). Ibid., valley between between Pirre and next most southernly peak, sloping hillside; 07°40′N, 077°42′W; 1250–1300 m; 10–20 Jul. 1977; *J.P. Folsom 4417* (MO). Ibid., campamento cerca del segundo mirador; 07°59′49″N, 077°42′43″W; 610 m; 2 Dec. 2016; *O.O. Ortiz 2713* (PMA).

**Identification.** This species is characterized by having short internodes, persistent fibrous cataphylls, more or less terete petioles (equal or longer than the blade), ovate to ovate-triangular blades with V-shaped sinus, non-naked posterior ribs, and numerous primary lateral veins (eight to 20 per side). In the field, this species can be vegetatively confused with *P. edenudatum* Croat, but the latter differs in having intact cataphylls and blades with three to four pairs of basal veins and five to six primary lateral veins per side.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Honduras, Nicaragua, Panama, and Venezuela. *Philodendron tenue* ocurrs along the elevation gradient of Cerro Pirre. The collections made indicate that this species can grow in semideciduous, evergreen, submontane and montane forests, at 80–1300 m.

***Philodendron tripartitum*** (Jacq.) Schott

**Material examined.** Vicinity Cerro Pirre, 17 km S of El Real, along trail from base camp, along Río Perisenico; 08°01′N, 077°44′W; 100 m; 28 Jul. 1994; *T.B. Croat 77187* (MO). Cerro Campamento (south of Cerro Pirre), cloud forest; 07°47′N, 077°43′W; 20–22 Mar. 1968; *J.A. Duke 15592* (MO). Parque Nacional Darién, Cerro Pirre, Rancho Frío; 08°01′16″N, 077°44′04″W; 103 m; 13 Apr. 2016; *O.O. Ortiz 2544* (PMA).

**Identification.** This species is characterized by having elongated internodes, intact and deciduous cataphylls in most of the nodes and by its deeply trilobed (sometimes trisect) blades with falcate segments. On Cerro Pirre, *Philodendron tripartitum* is the only species of the genus with trilobed or trisect leaves with the segments arranged forward. However, it could be confused with individuals of the genus *Syngonium*, which differs primarily in having milky sap and stamens fused as synandria.

**Distribution and ecology.** Belize, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Peru, and Venezuela. In the study area, this species ocurrs only in the semideciduous lowland forests, between 100 and 300 m. Individuals of this species can grow in both open and shady areas.

***Philodendron tuerckheimii*** Grayum (Fig. 7C)

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°56′N, 077°45′W; 800–1050 m; 29 Jun. 1988; *T.B. Croat 68920* (MO). Parque Nacional Darién, Serranía de Pirre, Rancho Plástico; 07°58′54″N, 077°42′30″W; 1128 m; 31 Jul. 2016; *O.O. Ortiz 2654* (MO, PMA). Ibid., campamento cerca del segundo mirador; 07°59′43″N, 077°42′39″W; 708 m; 2 Dec. 2016; *O.O. Ortiz 2703* (PMA).

**Identification.** This species is characterized by its nomadic vine life form (ramified habit), short petioles (50% of the length of the lamina) with horizontally splayed petiole sheaths, reddish brown small blades (when dry) with few primary lateral veins (five to seven per side) and solitary inflorescences with a relatively long female portion. According to the observations made in the field, the specimens of *Philodendron tuerckheimii* collected on Cerro Pirre have unusual coriaceous blades. Grayum (1996) documented this variation and stated that the specimens of Cerro Pirre are characterized by having larger petioles with the unsheathed portion of the petiole relatively long (up to 0.8 cm) and comparatively larger blades. Probably, the populations of Cerro Pirre correspond to a new taxon, but it is necessary to document in detail the morphological variations of these populations and to carry out additional collections.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, and Venezuela. According to the samplings, *P. tuerckheimii* ocurrs in the evergreen, submontane, and montane forests of Cerro Pirre; but it is more frequent throughout the montane cloud forest, located above 1100 m.

***Philodendron verrucosum*** L. Mathieu ex Schott

**Material examined.** Serranía de Pirre, trail 1–4 mi. N of Cerro Pirre on main ridge; 07°56′N, 077°42′W; 1000–1100 m; *R.L. Hartman 4829* (MO).

**Identification.** This species is characterized by having short internodes, subterete petioles (almost as long as

the blade), broadly ovate-cordate blades, glossy above (giving a velvety appearance), and especially by having scaly-setose indumentum in the stems, cataphylls, petioles, and inflorescences. *Philodendron verrucosum* is the only species of the genus having a scaly indumentum reported in the study area.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Nicaragua, Panama, and Peru. At the study site, *P. verrucosum* has only been reported in submontane forests, at 1000–1100 m.

***Philodendron wilburii*** var. ***longipedunculatum*** Croat & Grayum

**Material examined.** Parque Nacional Darien, middle slopes on W side of Cerro Pirre; 07°56′N, 077°43′W; 800–1050 m; 30 Jun. 1988; *T.B. Croat 69001* (MO). Ibid., Cerro Pirre, Rancho Frío; 08°01′14″N, 077°43′41″W; 143 m; 13 Apr. 2016; *O.O. Ortiz 2556* (PMA). Ibid., Rancho Plástico, camino hacia la cima del Cerro; 07°59′49″N, 077°42′45″W; 636 m; 15 Apr. 2016; *O.O. Ortiz 2582* (PMA). Ibid.; 07°59′13″N, 077°42′28″W; 1127 m; 30 Jul. 2016; *O.O. Ortiz 2648* (PMA). Ibid., campamento cerca del segundo mirador; 07°59′49″N, 077°42′43″W; 610 m; 3 Dec. 2016; *O.O. Ortiz 2717* (PMA).

**Identification.** This taxon is characterized by having elongated internodes, intact and deciduous cataphylls in most of the upper nodes, subteretes petioles, typically triangular-ovate blades, usually reddish when dry, primary lateral veins three to four per side, and long pedunculate inflorescences (peduncles usually longer than the spathe). This taxon differs from the typical variety *P. wilburii* var. *wilburii* (absent on Cerro Pirre), mainly in having greenish blades (when dry) and peduncles usually of equal size or smaller than spathe. In the herbarium, specimens of this taxon tend to confuse them with those of *Philodendron panamense* K. Krause, which differs by having ovate blades (blackish when dry) with four to seven primary lateral veins per side.

**Distribution and ecology.** Costa Rica and Panama. This taxon is distributed throughout the elevation gradient of Cerro Pirre. It can ocurrs both in semideciduous forests (to a lesser extent), as well as in evergreen, submontane, and montane forests at 90–1300 m.

***Rhodospatha moritziana*** Schott (Fig. 6F)

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68873* (MO). Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77086* (MO). Parque Nacional del Darién, Estación Rancho Frío at N base of Cerro Pirre, ca 9 km S of El Real, along Quebrada Perisenico, in forest; 08°01′N, 077°44′W; 70–270 m; 8 Oct. 1987; *B.E. Hammel 16109* (MO). Ibid., Cerro Pirre, Rancho Frio, cerca de la estación de la antigua ANAM; 08°01′16″N, 077°44′04″W; 103 m; 17 Apr. 2016; *O.O. Ortiz 2597* (PMA).

**Identification.** *Rhodospatha moritziana* is distinguished by having terrestrial habit, short internodes, relatively broad blades and inflorescences with whitish spathes, and uniform spadices with naked bisexual flowers. So far, *R. moritziana* is the only species with consistent terrestrial habit of the genus in Panama. Due to its terrestrial habit, it is possible to confuse the individuals of *R. moritziana* with those of the genus *Spathiphyllum*. On Cerro Pirre, *R. moritziana* differs from all species of *Spathiphyllum* by having reddish-punctate blades on the lower surface, with numerous primary lateral veins.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Panama, Peru, and Venezuela. In the study site, this species ocurrs along semideciduous and evergreen forests, between 90 and 800 m. It usually grows in shaded areas with semi-flooded soils, near the banks of rivers and streams.

***Rhodospatha wendlandii*** Schott (Figs 6G, 7A)

**Material examined.** Vicinity Cerro Pirre, along trail from base camp to Rancho Frío on slopes of Cerro Pirre; 07°58′N, 077°43′W; 200–450 m; 27 Jul. 1994; *T.B. Croat 77128* (MO). Parque Nacional Darién, Cerro Pirre, Camino hacia Rancho Plástico, despues del primer mirador; 08°00′57″N, 077°43′41″W; 157 m; 14 Apr. 2016; *O.O. Ortiz 2573* (PMA). Ibid.; *O.O. Ortiz 2574* (PMA).

**Identification.** This species is characterized by its nomadic vine life form (appressed-climbing habit), distichous leaves, relatively long petioles with deciduous sheaths, large blades with numerous primary lateral veins, often truncated at base, inflorescences with creamy-pinkish spathes, and uniform pinkish spadices with naked bisexual flowers. On Cerro Pirre, *R. wendlandii* is the only species of the genus that presents a nomadic vine life form. It is possible to confuse this species with non-cordate *Philodendron* species, but they differ in having spirally arranged blades, with fewer primary lateral veins and segmented spadices with unisexual flowers.

**Distribution and ecology.** Belize, Colombia, Costa Rica, Guatemala, Honduras, Mexico, Nicaragua, and Panama. In the study area, this species ocurrs along semideciduous and evergreen forests, between 90 and 800 m.

***Spathiphyllum laeve*** Engl.

**Material examined.** Summit of Cerro Pirre, cloud forest; 07°55′21″N, 077°42′57″W; 1000–1400 m; 29 Dec. 1972; *A.H. Gentry 7011* (MO).

**Identification.** This species is characterized by having terrestrial habit, erect petioles, oblong-elliptic short acuminate blades, acute at base; inflorescences with narrow greenish spathes (slightly decurrent in the peduncles), greenish spadices, and flowers with fused tepals. *Spathiphyllum laeve* is the only species of the genus in Panama that has flowers with fused tepals and obsolete styles.

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, El Salvador, Nicaragua, and Panama. On Cerro Pirre, *S. laeve* is a rare species because it is known from a single collection. According to the collection information, this species ocurrs in submontane or montane forests above 1000 m.

***Spathiphyllum phryniifolium*** Schott

**Material examined.** Vicinity Cerro Pirre, along trail from base camp to Rancho Frío on slopes of Cerro Pirre; 07°58′N, 077°43′W; 200–450 m; 27 Jul. 1994; *T.B. Croat 77153* (MO). Parque Nacional Darién, Cerro Pirre, Rancho Frío; 08°01′14″N, 077°43′41″W; 143 m; 13 Apr. 2016; *O.O. Ortiz 2557* (PMA). Ibid., campamento cerca del segundo mirador; 07°59′49″N, 077°42′43″W; 610 m; 3 Dec. 2016; *O.O. Ortiz 2715* (PMA).

**Identification.** This species is characterized by having terrestrial habit, minutely denticulated blade margins (when fresh), typically lanceolate, obtuse to rounded at base; inflorescences with green lanceolate spathes, markedly decurrent on the peduncle, green spadices, and flowers with separate tepals and prominent conical styles. In the study area, only two species of the genus *Spathiphyllum* have been recorded and both are mainly differentiated by the morphology of the inflorescences and flowers (see couplet five of the key).

**Distribution and ecology.** Belize, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, and Panama. This species of wide distribution, occurs in the semideciduous and evergreen forests of Cerro Pirre, between 90 and 800 m. Individuals of this species usually grow near rivers and streams or in very steep slopes areas.

***Stenospermation angustifolium*** Hemsl. (Fig. 8D)

**Material examined.** Summit of Cerro Pirre, cloud forest; 07°55′21″N, 077°42′57″W; 1000–1400 m; 29 Dec. 1972; *A.H. Gentry 6949* (MO). Serranía Pirre, 1.5–2.5 mi. S on ridge from intersection with trail down to Rancho Frío, cloud forest; 07°57′N, 077°43′W; 900–1000 m; 11 Jul. 1977; *R.L. Hartman 4501* (MO, PMA). Parque Nacional Darién, caminando entre Campamento Rancho Frío No. 2 hacia la cima de Cerro Pirre; 08°00′N, 077°45′W; 700–1000 m; 7 Feb. 1991; *H. Herrera 856* (MO). Ibid., Rancho Frío, cascada arriba; 08°00′58″ N, 077°43′24″ W; 164 m; 14 Apr. 2016; *O.O. Ortiz 2567* (PMA).

**Identification.** This species is characterized by having epiphytic habit, elongated and slender stems, slightly coriaceous and small blades; inflorescences with white spathes and uniform whitish spadices, with naked bisexual flowers. *Stenospermation angustifolium* is the only species of Cerro Pirre that has shortly stipitate whitish spadices (stipe of up to 2 mm long).

**Distribution and ecology.** Colombia, Costa Rica, Ecuador, Honduras, Nicaragua, Panama, and Peru. This species of wide distribution ocurrs throughout the Cerro Pirre elevation gradient, between 90 and 1400 m.

***Stenospermation ellipticum*** Croat & D.C. Bay (Fig. 8F)

**Material examined.** Serranía de Pirre, along steep narrow ridge from Alturas de Nique to Cerro Pirre, ca 9 km from Alturas de Nique, ca 8 km W of Cana gold mine, virgin cloud forest, lower montane rain forest (Holdrige Life Zone System); 07°49′N, 077°43′W; 1480–1520 m; 27 Jul. 1976; *T.B. Croat 37888* (MO). Parque Nacional Darién, Serranía de Pirre, Rancho Plástico; 07°58′54″N, 077°42′30″W; 1128 m; 31 Jul. 2016; *O.O. Ortiz 2651* (MO, PMA).

**Identification.** This species is characterized by having epiphytic habit, short and thick internodes; dark green mottled petioles, elliptical blades, glossy above, acuminate at apex, and long pedunculate inflorescences (peduncle 17–35 cm long) with cylindrical yellow spadices. Specimens of this species were determined in the past as *S. sessile* Engl., which differs in having pale petiole sheaths (when dry), smaller blades (proportionally longer than petioles) with smooth and semiglossy upper surfaces.

**Distribution and ecology.** Colombia and Panama. In the study site, *Stenospermation ellipticum* ocurrs in submontane and montane forests above 900 m. Due to the size and weight of the individuals, they tend to fall off the branches and grow as accidental terrestrial plants.

***Syngonium hoffmannii*** Schott (Fig. 6E)

**Material examined.** Middle slopes on W side of Cerro Pirre; 07°57′N, 077°46′W; 550–760 m; 28 Jun. 1988; *T.B. Croat 68892* (MO). Vicinity Cerro Pirre, along trail from base camp to Rancho Frío on slopes of Cerro Pirre; 07°58′N, 077°43′W; 200–450 m; 27 Jul. 1994; *T.B. Croat 77150* (MO). Summit of Cerro Pirre, cloud forest; 07°55′21″N, 077°42′57″W; 1000–1400 m; 29 Dec. 1972; *A.H. Gentry 7027* (MO). Parque Nacional Darién, Serranía de Pirre, Rancho Plástico; 07°58′54″N, 077°42′30″W; 1128 m; 31 Jul. 2016; *O.O. Ortiz 2655* (PMA). Ibid., campamento cerca del segundo mirador; 07°59′43″N, 077°42′39″W; 708 m; 3 Dec. 2016; *O.O. Ortiz 2710* (PMA).

**Identification.** *Syngonium hoffmannii* is characterized by its nomadic vine life form, vegetative parts frequently glaucous, milky sap; consistently trifoliolate leaves with three to eight pairs of primary lateral veins in the central leaflet, reddish when dry; few inflorescences (one to two) per node with reddish or purplish spathe tubes internally. This species differs from the rest of the species of the genus present on Cerro Pirre by having brown-reddish blades when dry and primary lateral veins emerging from the midrib at an angle of more than 35° (see couplet 62 of the key).

**Distribution and ecology.** Costa Rica, Honduras, Nicaragua, and Panama. This species grows throughout the Cerro Pirre elevation gradient, at 200–1400 m.

***Syngonium podophyllum*** Schott (Fig. 6D)

**Material examined.** Parque Nacional Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77113* (MO). Vicinity Cerro Pirre, 17 km S of El Real, along trail from base camp, along Río Perisenico; 08°01′N, 077°44′W; 100 m; 28 Jul. 1994; *T.B. Croat 77182* (MO), Parque Nacional Darién, Cerro Pirre, Rancho Frío; 08°01′16″N, 077°44′04″W; 103 m; 13 Apr. 2016; *O.O. Ortiz 2540* (PMA). Ibid., orillas del río Perresenico; 08°01′15″N, 077°43′58″W; 260 m; 1 Dec. 2016; *O.O. Ortiz 2696* (PMA).

**Identification.** *Syngonium podophyllum* represents a species with high morphological diversity (Croat 1981). This species is characterized by its nomadic vine life form, milky sap, elongated and slender internodes (on Cerro Pirre), trifoliolated to five-foliolated compound leaves, lateral leaflets with the auricles truncated to sagittate or hastate lobed; inflorescences up to eight per node, spathes with greenish tubes and whitish blades, spadices creamy-brown in the female portion, creamy-white in the sterile portion, whitish in the male portion and brownish syncarps. On Cerro Pirre, this species can be confused with *Syngonium* sp. 1, which differs fundamentally in having the unsheathed portion of the petiole larger than petiole sheaths and the lateral segments of the lamina auriculate, obovate, oblong to elliptically lobed at base.

**Distribution and ecology.** Greater Antilles, Bahamas, Belize, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Guyana, French Guiana, Haiti, Honduras, Mexico, Nicaragua, Panama, Peru, Suriname, Trinidad and Tobago, USA, and Venezuela. This species of wide distribution ocurrs in semideciduous and evergreen forests of Cerro Pirre, at 90–800 m. It is very common in open areas, along trails, and near the banks of rivers and streams.

***Syngonium schottianum*** H. Wendl. ex Schott

**Material examined.** Vicinity Cerro Pirre, 17 km S of El Real, along trail from base camp, along Río Perisenico; 08°01′N, 077°44′W; 100 m; 28 Jul. 1994; *T.B. Croat 77179* (MO). Parque Nacional Darién, Cerro Pirre, Rancho Frío; 08°01′16″N, 077°44′04″W; 103 m; 13 Apr. 2016; *O.O. Ortiz 2535* (PMA).

**Identification.** This species is characterized by its nomadic vine life form, milky sap, elongate internodes, ovate simple blades, cordate-sagittate at base, greenish-white on the lower surface; inflorescences usually four per node, greenish spathe tube externally, red-purple to violet internally; whitish spathe blade on both surfaces and greenish to whitish syncarps. *Syngonium schottianum* is the only species of the genus on Cerro Pirre that has simple leaves.

**Distribution and ecology.** Costa Rica, Honduras, Nicaragua, and Panama. At the study site, this species ocurrs along semideciduous and evergreen forests, between 90 and 800 m. Individuals of this species generally grow in primary forests with low light intensity.

***Xanthosoma mexicanum*** Liebm.

**Material examined.** Cerro Pirre; 07°52′N, 077°44′W; 11 Apr. 1967; *N. Bristán 596* (MO).

**Identification.** This species is characterized by having terrestrial habit, subterranean cormose stems, densely pubescent subterete petioles, deltate or ovate to oblong-ovate simple blades, cordate to subsagittate at base, pubescent on both surfaces; spathe tube uniformly green externally, purple internally and spathe blade whitish or cream; spadices with whitish male portion, purple sterile portion, and pale-yellow female portion. On Cerro Pirre, *Xanthosoma mexicanum* is the only species of the genus that has pubescent leaves.

**Distribution and ecology.** Brazil, Colombia, Costa Rica, El Salvador, Guatemala, Mexico, Nicaragua, Panama, and Venezuela. In the only examined specimen it was not specified in which locality of Cerro Pirre was found. Due to this, it is not possible to know the habitat where this species ocurrs in the study site. According to Croat et al. (2017b), the individuals of *X. mexicanum* disappear during the dry season and reappear in the rainy season.

***Xanthosoma hammelii*** Croat, Delannay & O. Ortiz

**Material examined.** Cerro Pirre, vicinity of station along Río Perisenico; 08°01′N, 077°44′W; 110 m; 26 Jul. 1994; *T.B. Croat 77089* (MO). Parque Nacional del Darién, Estación Rancho Frío at N base of Cerro Pirre, ca 9 km S of El Real, along Quebrada Perisenico, in forest; 08°01′N, 077°44′W; 70–270 m; 8 Oct. 1987; *B.E. Hammel 16097* (MO). Ibid., Cerro Pirre, Rancho Frío, cerca de la estación de la antigua ANAM; 08°01′16″N, 077°44′04″W; 103 m; 17 Apr. 2016; *O.O. Ortiz 2599* (MO, PMA).

**Identification.** This species is characterized by having erect and elongated aereal stems; petioles almost as long as or slightly longer than blades, drying greenish, ovate-cordate to sagittate blades with sharp posterior lobes; spathe tube greenish on both surfaces and spadices with yellowish-orange female portion.

**Distribution and ecology.** Endemic to Panama. In the study area, it has only been reported on the river or streams banks, in the semideciduous lowland forest, between 100 and 300 m.

## Discussion

The Cerro Pirre area contains about 20% of the 436 described species of Araceae recorded in Panama. For

Darién only, the Cerro Pirre contains about 69% of the 121 described species recorded for this province (Correa et al. 2004).

The most outstanding genera for their richness, turned out to be *Anthurium* (39 spp.) and *Philodendron* (28 spp.). Both genera together contain 72% of the total aroid species of Cerro Pirre. These results are similar to those obtained in other authors' work in the Neotropics, such as Bay (1996), Balcázar-Vargas et al. (2000), Mora et al. (2006), Trujillo et al. (2007), and Lingán-Chávez (2008), where *Anthurium* (to a greater extent) and *Philodendron* are the most diverse genera. According to Croat (1994), *Anthurium* and *Philodendron* are characterized by being the most diverse genera of the family, so much so that together they represent the highest richness of Araceae species, compared to the total number of species included in all the remaining Neotropical genera combined. In Panama, *Anthurium* comprises a total of 206 described species (including 96 endemics), representing the most diverse genus in the country. Cerro Pirre with 39 *Anthurium* species (16 endemic), contains about 19% of Panamanian species (about 17% of the endemic species in the country). On the other hand, *Philodendron* with 103 described species (including 27 endemics), represents the second largest genus of Araceae in Panama (Correa et al. 2004). Cerro Pirre comprises 28 species of *Philodendron* (including five endemic species), which is equivalent to 27% of the species reported for the country and 22% of the total endemism of this genus in Panama.

We were able to correct the taxonomic identification of 21 herbarium specimens (Table 1), which allowed in certain cases, the exclusion of some species previously recorded for Cerro Pirre (cf. Croat 1986b, 2004; TROPICOS 2018). The correct identification in most cases was given by the proper documentation of the species in the field.

The Cerro Pirre area contains a significant level of endemism, as 27% of the species present in the study area are endemic to Panama. Due to the isolation between the mountain ranges, these sites present numerous endemic species (Bermúdez et al. 2000; ANAM 2010). Cerro Pirre has been considered to harbor a high level of endemism, as it includes many endemic plant species (Luteyn 1976; Croat 1986b, 1997; Rojas-Alvarado 2002; Zhu and Croat 2004; Kolanowska et al. 2012; Monro 2012; Croat et al. 2017b; TROPICOS 2018) and endemic animals (Wake et al. 1970; Robbins et al. 1985; Stattersfield et al. 1998; Angehr et al. 2003; Batista et al. 2014; Hruska et al. 2016; Ibáñez et al. 2017; Renjifo et al. 2017).

Our results demonstrate the need to carry out thorough inventories in poorly studied sites, such as exists in the Darién, and to stress the importance of floristic and taxonomic studies as the basic tool to advance our knowledge of biodiversity.

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## Authors' Contributions

OOO collected the specimens and wrote the text; OOO and TC made identifications and reviewed herbarium material; TC, MdS, and RMB contributed to the design and implementation of the research, and reviewed all versions of the manuscript.

**Table 1.** List of species excluded from Cerro Pirre, including specimens examined and the updated identifications.

| Species excluded from Cerro Pirre | Identification given in this work | Specimens examined |
|---|---|---|
| *Anthurium caperatum* Croat & R.A. Baker | *Anthurium dukei* Croat | *Croat 68955* (MO), *Croat 68865* (MO), *Folsom 6320* (MO), *Hartman 4812* (MO), *4593A* (MO). *Herrera 872* (MO) |
| *Anthurium erythrostachyum* Croat | *Anthurium hartmanii* Croat & O. Ortiz | *Folsom 8544* (MO), *Folsom 4348* (MO), *Folsom 6303* (MO), *Hartman 8566* (MO), *Hartman 4596* (MO), *Zapata 1542* (MO) |
| *Anthurium formosum* Schott | *Anthurium dukei* Croat | *Duke 15699* (MO) |
| *Anthurium hutchisonii* Croat | *Anthurium rubrifructum* Croat | *Croat 68942* (MO), *Croat 68864* (MO), *Gentry 6993* (MO), *Gentry 7148* (MO) |
| *Anthurium panamense* Croat | *Anthurium dukei* Croat | *Croat 68956* (MO) |
| *Dieffenbachia nitidipetiolata* Croat & Grayum | *Dieffenbachia longispatha* Engl. & K. Krause | *Croat 68854* (MO) |
| *Monstera obliqua* Miq. | *Monstera pittieri* Engl. | *Croat 77130* (MO) |
| *Stenospermation spruceanum* Schott | *Stenospermation angustifolium* Hemsl. | *Gentry 6949* (MO) |

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